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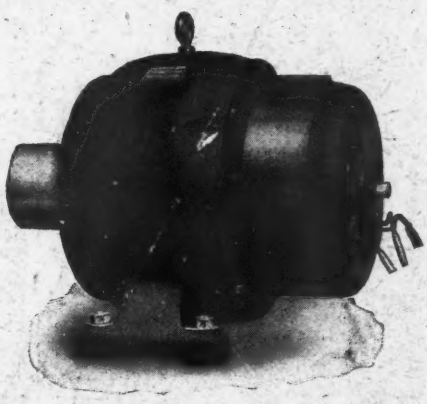

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INDUSTRIAL ORGANISATION.

As a nation we know a good deal more about German means and methods than we did a year and a half ago, and the voices of those who have cried for years in the wilderness anent the national importance of industrial reform are now listened to. The outstanding characteristic of the German is his thoroughness. It permeates his every walk of life—even his methods of "frightfulness." At times this characteristic, coupled with a good proportion of *Dummheit*, leads him into the most absurd and "impossible" of situations (as witness the majority of his diplomatic machinations)—at times, it leads him into a positive bewilderment of micro-detail (as witness many of his researches, which produce an amazing wealth of indigestible data but no conclusions). These, however, are the results of becoming obsessed by the system, and they do not alter the fact that Teutonic developments during the past fifty years have largely resulted from Teutonic thoroughness. Without any attempt to transplant a German quality to an uncongenial soil we shall do well to adapt any good features that we have observed in German industrialism and commercialism to our own circumstances before the German detects and tries to remedy the defects of his system.

As we have heard very frequently of late, the broad principles of prosperity are that as little as possible of manufactured products be imported, and that organised efficiency of equipment, processes and policy be found not only in individual firms and individual industries, but also in our national industry as a whole. A central body is needed which shall be qualified and equipped to collect information relating to markets and sources of supply and able to deal with the whole of our industry and commerce as one vast business enterprise. In a large industrial undertaking there are frequent conferences of departmental heads to ensure that the whole concern which may embrace works in half a dozen towns, is taking best joint advantage of markets and transit facilities. From time to time, fresh works or fresh departments are started to take advantage of the by-products of others or to supply the needs of others in the joint concern. Why should such organisation and such policy stop short at the largest private firms? Why not national conferences along similar lines? If Government lethargy and hopeless officialdom form the chief stumbling block, then that block should be cleared away, or else the manufacturers and commercial firms of this country must establish an organisation of their own. There seems nothing impossible in the suggestion that every firm should be given a number of votes proportional to its productive turnover, and invited to assist in electing a central body which should have the development of national industry and commerce as the beginning and end of its aims.

If there be a chance of such a body getting effectively to work, it is imperative that the first steps be taken by firms and individuals of high standing,

so that no suspicion of private interest be aroused, and it is equally important that it be understood that the co-operation of every firm, large and small, is needed. There can thus be formed what may be called an Industrial Parliament, entirely free from the baneful influence of politicians. Its resources will be immense without placing any appreciable burden on individual "constituents." Provided that there is nothing of a hole-in-the-corner nature about the floating of such a scheme, there seems to be no reason why it should not at once assume national proportions. As a national organisation, embracing every industry, nothing could resist its activities, and we believe that on a proper elective basis it would command general confidence and energetic support.

A matter closely associated with the lessons in national industrial organisation and intensive organisation of individual works taught to us by the present war, is the value of national testing and approving. For years past the National Physical Laboratory has been gaining rapidly in reputation, and ever-increasing numbers of private firms have taken advantage of the services it offers in standardisation and testing work. Now that it has been made the final arbiter in so many matters connected with the production of munitions, its scope and qualifications should be brought home more clearly than ever to manufacturers all over the country, and its relations with British industry should be permanently improved thereby, to the benefit of all concerned.

It is no mean work which the National Physical Laboratory has accomplished in extending its staff and equipment to undertake the responsible work of testing wireless and all sorts of other electrical equipment—on top of an immense amount of research work and mechanical standardisation and testing, such as inspection of gauges (the final arbiter of accuracy in shell production), testing constructional materials, and so on. In due course publication of what has been done, and the means whereby the high standard of precision has been maintained, should inspire confidence and excite that interest which has unfortunately been rather lacking in the past. In short, its services in war work should place national testing and standardisation on a broader, firmer basis than heretofore. This, in conjunction with the revolutionary reorganisation which has taken place in our industry as a whole, will place us in a much better position to face the industrial struggle to come. And there is reason to believe that we shall need every advantage that can be given to us by circumstances and by our own efforts.

Telephony in 1915.

The outbreak of the conflict now raging between civilisation and barbarism cut short experimental research in the Old World and compelled our investigators to turn their attention from peaceful progress to the arts of war; especially was research in wireless telegraphy and telephony forbidden ground except to the scientific staffs of the Army and Navy. Just before the commencement of the war sundry hints were thrown out by the Marconi Co. as to the approaching success of its efforts to place wireless telephony on a commercial footing, but whether sufficient progress had been made to enable our defenders to make use of it in the course of their operations we do not know, and if we did, we should not tell. But in the Western Hemisphere no such restrictions obtained, and our American friends made good use of the unique opportunities at their command, with the result that the year 1915 will for ever be distinguished by two great achievements—trans-Continental and trans-Atlantic telephony.

The former was inaugurated on January 25th, when the veteran inventor of the telephone, Dr. Alexander Graham Bell, conversed with his assistant of 1876, Mr. T. A. Watson, over 3,400 miles of line between New York and San Francisco, a line consisting of 1,480 tons of copper wire per circuit, carried on no fewer than 130,000 poles. That the human voice unaided should be capable of energising so great a mass of metal, of so attenuated dimensions, so effectually as to be recognisable at the far end of the line, is inconceivable; the feat, in fact, was only made possible by injecting into the circuit energy derived from external sources by the aid of relays, the development of which in itself was a striking achievement.

No such assistance *en route* was possible in the case of wireless telephony; once launched, the etherial vibrations must pursue their course on their own merits, and therefore we may perhaps regard the latter accomplishment as the more remarkable, although it represented only a tentative performance, and has not, like the former, become a commercial proposition. In this instance the human voice controlled at their source electric waves which traversed a distance of 4,900 miles, and still remained capable of being understood when reconverted into sound waves. As the longest distance covered in the former case was 4,750 miles, the palm for the greatest distance of transmission of speech must be awarded to wireless telephony. What will be accomplished in the future we cannot say, but we can safely predict that future achievements will put in the shade anything that we dare imagine now. And these two great feats in themselves suffice to mark the year as one of the most notable in the history of electrical methods of communication.

Copper.

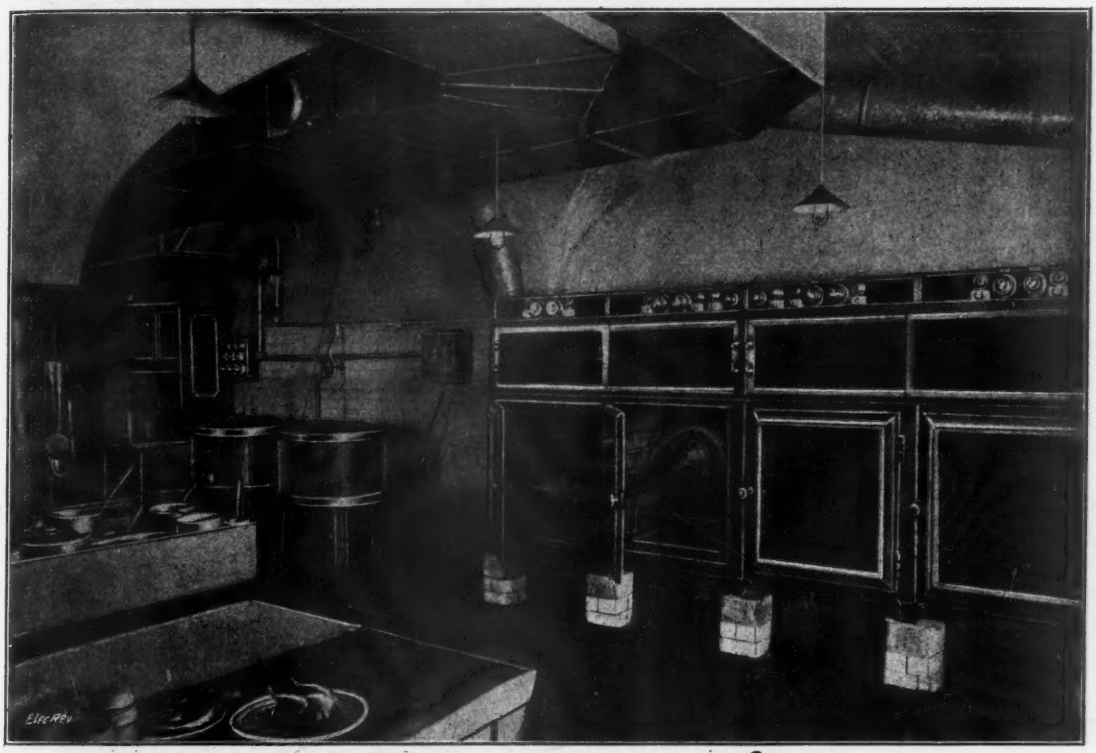
There has been no holding back the copper market, the strength of which increased daily during the closing weeks of the old year, and which shows no signs whatever of relaxing. There has been an enormous business done in America, a large proportion of which was on behalf of the Allied Governments, and it was the buying in this connection which definitely pushed the market up to round 22 cents a lb. for electrolytic, the movement in America being followed by an upward rush in prices here which has carried refined material to about £111 a ton c.i.f. Liverpool. The position is one of the greatest gravity, for stocks have been reduced to entirely trifling proportions, and it seems hopeless to look for any substantial abatement in the material conditions ruling the market at the present juncture. It is all too apparent that the world's production has proved unequal to meeting the enormous demands for munitions. While production cannot well be extended, there seems no limit to the absorption of metal for war purposes. It is estimated by those in a position to speak with some authority, that the Allies are using up about 35,000 to 40,000 tons of copper a month, and the estimate seems to be pretty well based as far as can be ascertained from the broad indications available.

There are, of course, no approximate figures either of production or consumption now issued, but as the world's output of copper can be put down at about a million tons a year, the importance of the war can easily be gauged from a consideration of the facts set forth. So far as general consumption is concerned, each week sees a lessening in the business done. Labour scarcity is reported in all directions, while copper is practically too dear to be used for anything other than munition requirements, where expense is a factor which never enters into consideration. How far the upward movement may be carried is a mere matter of conjecture, but it may be said that there is not the slightest sign, so far, of any relief coming to the situation. No doubt, if there were any sign of peace there would be a sharp break in prices, but it is by no means a foregone conclusion that the termination of hostilities and the resumption of normal national conditions in Europe would produce a permanent lowering of prices, for the accumulated demands of the warring nations, to say nothing of the necessity of making good the hundreds of millions sterling of damage, might quite easily keep copper for an indefinite period upon a higher plane than has been seen within living memory.

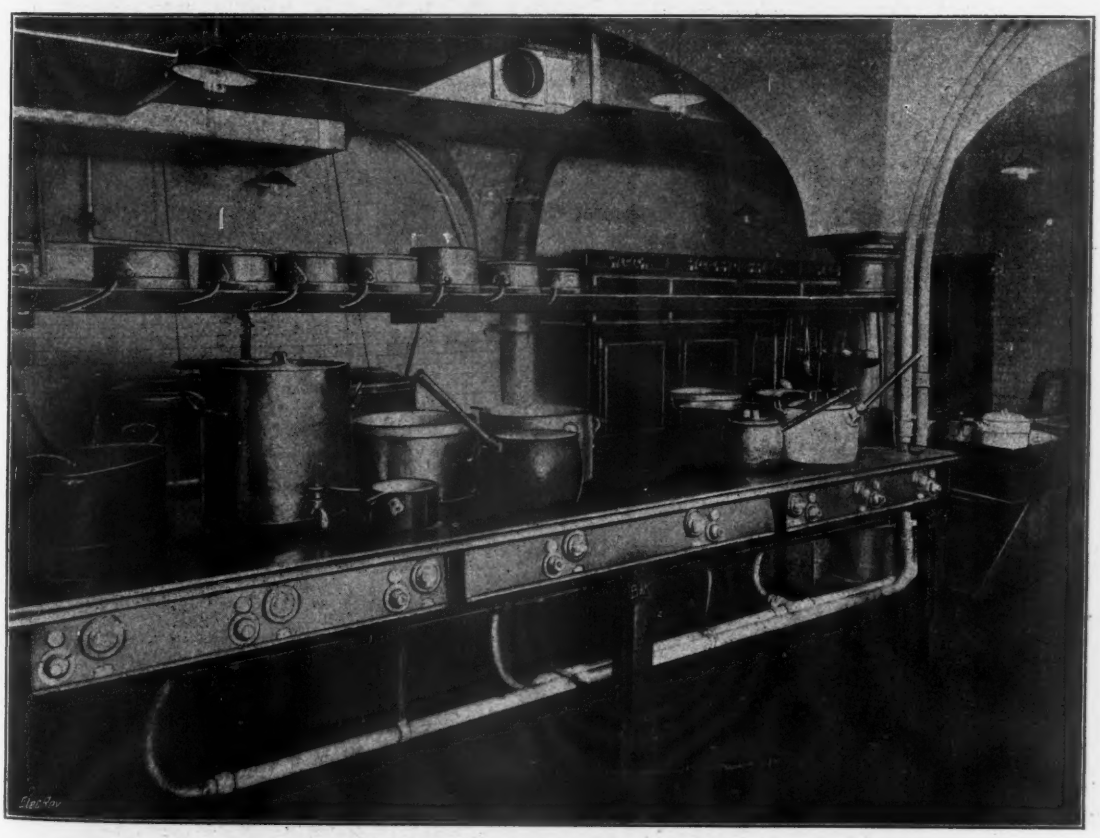
ELECTRIC COOKING AT EUSTON STATION.

In connection with the handsome new dining-room which has recently been opened by the London and North-Western Railway Co. at Euston Station, advantage has been taken of the opportunity to install a modern, and indeed model, system of electric cooking, in substitution for the previous cooking arrangements which involved the use of steam and gas-heated apparatus.

The complete electrical equipment has been supplied by the Brompton and Kensington Accessories Co., and is installed in a basement kitchen, and servery and grill adjoining the dining-room. The kitchen equipment comprises four ovens, each measuring internally 2 ft. by 2 ft. by 2 ft. 6 in. high, with the heating elements arranged



Interior of Electric Kitchen, Euston Station, showing Ovens, Ham Boilers, &c.



Large Boiling Table, Euston Station Electric Kitchen.

around the sides and back. Seven different heats are provided, controlled through two three-way Diamond H switches, with pilot lights, in which the bulbs are enclosed in metal spinnings to safeguard against breakages, and Zed fuses—accessories of this type being used throughout the equipment. Above the oven range is a hot closet, with a maximum loading of 3 KW. controlled by two single-pole switches, and the total loading of the oven range is 23 KW.

Adjoining the oven range are two ham-boilers, each of 30 gallons capacity taking about eight average-size hams, together these have a loading of 7·5 KW., and adjoining this apparatus is a double grill for kitchen use, both apparatus being provided with heat regulation, and the latter—with 7 KW. loading—having four push-and-pull switches, with fuses and pilot lights. In the centre of the kitchen is what forms, in more senses than one, the technical *pièce de résistance* of the equipment—a large boiling table equipped with 23 hot plates of from 2,000 to 1,200 watts maximum loading, giving a total loading of 38·6 KW. Each plate is provided with a three-heat regulation switch, fuse and pilot light, these accessories being arranged round the frame of the top plate. A bain-marie, arranged in two sections with 1,500 watts, maximum loading, a hot closet for 1,000 plates with two-heat regulation and a loading of 3·7 KW., and a vegetable steamer with six nests, and a 4·5-KW. loading with three-heat regulation, are also installed; while adjacent to the service lifts in the entrance, which communicate with the servery above, is a small hot closet, of 2·3-KW. loading, for keeping the food warm while *en route* to the servery. The service lifts are of the Waygood automatic type, with push-button control.

In the servery—which is, of course, close to the dining-room—there is, adjacent to the lift, a vegetable server with a 4·2-KW. loading and two heats to each compartment; the top plate of this server is arranged for the reception of two nests or upper sections of the vegetable steamer, which are transferred direct with their cooked contents to it, preparatory to serving. Two soup tureens kept hot by means of water baths are also fitted; the heat regulation is controlled by six push-and-pull switches.

View in the Servery, showing Carving Table and Vegetable Server.

The servery also contains a large carving table with five cutting dishes for joints and other sundries; an electrically heated shelf behind enables plates and food to be kept hot while waiting delivery, and hot cupboards are also provided below the table for keeping food warm.

The total loading of this apparatus is 10 KW. and heat regulation by means of six single-pole switches is provided.

Yet another piece of apparatus has been installed—viz., the dining room electric grill, which, as usual, is adjacent to, and visible from, the dining room. This has two grilling compartments, with hot closets above and below, and has a 12·5-KW. loading. The switches in this case are of the push and pull type. It will be seen that the equipment is a very complete one in every way, and the kitchen is in many respects a model one, being provided with mechanical ventilation, fresh air being introduced and used air exhausted through special trunking, while the kitchen is tiled and finished in white, and electrically lighted throughout. In fact, one cannot help the reflection that such an excellent example of modern hygienic cooking methods should not be hidden from the public view, and that both the company and the public would be gainers were it allowed to advertise itself directly, as well as indirectly, by the excellent cooking results which, we understand, are being obtained. It may be mentioned that each apparatus is on a separate fused circuit and each circuit is led through a meter with a view to obtaining complete cost records.

The total number of meals served at present per day is about 400; the equipment has a total loading of 130 KW. The work has been carried out under the supervision of Lieut.-Colonel Cortez-Leigh, T.D., R.E., chief electrical engineer to the L. and N.-W. Rly. Co., to the requirements of the Hotel Department.

DIRECT-CURRENT MOTOR MAINTENANCE.

By S. Lees.

(*Continued from Vol.* 77, *page* 838.)

The box type of brush-holder has now almost completely ousted the hinged-arm or the grip type which was so prevalent a few years ago. The grip-holder, when constructed properly, with due regard to its right application, makes a thoroughly good and satisfactory brush clip; the box type, however, possesses peculiar advantages which render this form more suitable for use on modern multipolar motors. The smaller amount of circumferential space occupied by the box-holder affords greater protection against the detrimental effects of "flash-over." And with a tendency ever towards economy, especially in the direction of cubical dimensions, the commutator end, particularly in the small-powered machines, becomes a detail of extremely restricted dimensions, and consequently, the short-pitched brush gear, practically unavoidable under such circumstances, gets uncomfortably crowded. Hence, faults which become manifest in "flashing-over" invariably play havoc with the brush-gear. It is possible, and moreover, by no means a rare occurrence, for a "flash-over" to maintain an arc sufficiently destructive in effect to wreck the brush-holders—the circuit fuses remaining intact, although not under-rated. The complication of detail so common in brush-holders of only a few years ago has gradually disappeared, and the absence of "knock-off" catches has rendered the present-day box-type holder a very simple affair by comparison with its earlier prototypes. The helical spring, too, has given way to some modification or other of volute spring of ribbon section; and by suitably shaping the free end of the spring to correspond to the brush head, auxiliary triggers are dispensed with. Given a sufficient number of convolutions in the spring, tension adjusting gear is unnecessary, as the pressure exerted at the free extremity of the spring is practically uniform throughout the comparatively small range of travel required for nearly all, if not all, commercial brushes.

Many manufacturers have adopted this construction as a standard type, using the same size of holder in multiple as required. Some little time back two well-known makers had turned out quite a number of big machines fitted with this type of brush-holder for tramway traction service. In both cases under review the brush-gear was of unusually massive build, but an unforseen weak point pretty nearly caused the condemnation of the whole brush-gear. This circumstance came about as follows: The position of the brush-spring normally stood out considerably proud of the body of the holder casting, as will be seen on reference to

fig. 8. Obviously, under the abnormal conditions inseparable from traction operation, the effects of "flashing-over" would be more concentrated on the outside turns (*a*) of the spring than on any other part, and so it proved. Spring renewals became of rather too frequent occurrence, and there was always the added danger of a severed spring uncoiling and coming in contact with the commutator many bars behind

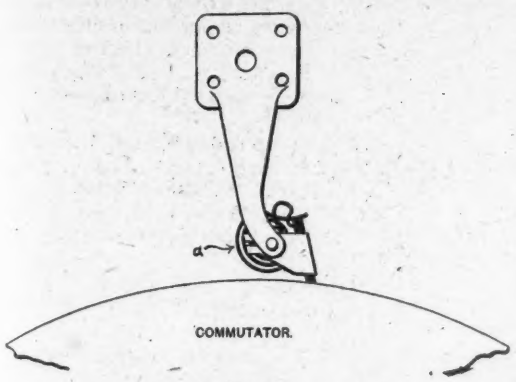


FIG. 8.

the same line of brushes. The writer has good reason for citing this case, as he had the "pleasure" of rehabilitating a number of installations of machines afflicted with the trouble described. An effective expedient for protecting brush-gear, especially the weaker and more exposed details thereof, is to shield the holder with a guard made of vulcanised fibre (sheet), one method of application being represented at *a* in fig. 9.

As an external protective agency the employment of vulcanised fibre finds many useful applications in the operation of electrical machinery. A prolific source of breakdown is

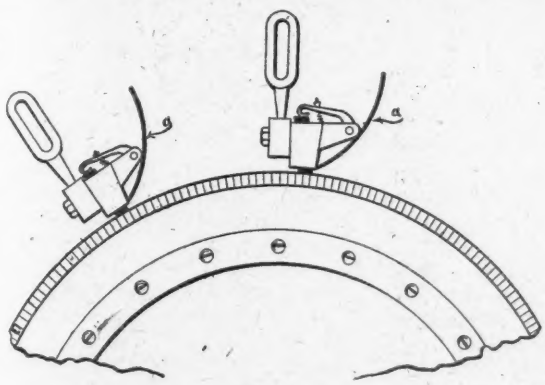


FIG. 9.

that arising from the failure of field-coil connecting wires. In practically all makes of machines, especially of motors, the conventional short tag of wire is used. Sometimes in the winding of the spool a finishing turn of heavier gauge wire is used for strength, but invariably the frail tag end issues at a point more or less inconvenient for connection with the adjacent coil. After the usual servings of spirit varnish the insulation becomes so brittle that great care is required in handling to avoid breaking off the said tag end of wire, which would, of course, necessitate unwrapping the coil covering before repair could be made. There are very few firms indeed that fit a really sound and mechanically safe

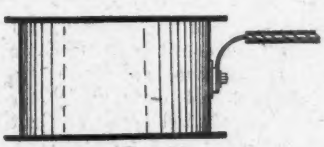


FIG. 10.

terminal attachment for field-coils. Two neat devices for this purpose are shown in figs. 10 and 11. As a safeguard against accidental breakage or damage to the connecting wires, a good plan is to protect the leads by a length of fibre tubing, as represented at *a* in fig. 11. Fibre tubing may also be used with advantage on the terminal ends of brush-leads and similar connections. This addition obviates

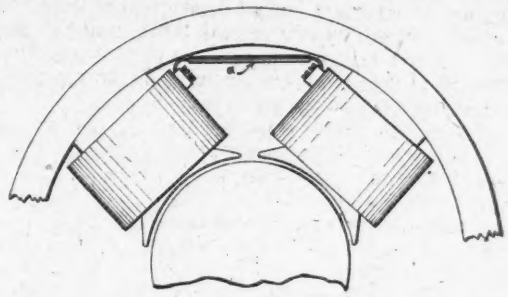


FIG. 11.

the unsightly mess of a matted bunch of greasy dishevelled braiding or flabby overgrown heap of decomposing rubber, and, moreover, makes for greater safety. The desirable neatness too of the finish given to such connections is obvious on reference to fig. 12.

Regarding carbon brushes, the writer asserts deliberately that practically all the troubles arising therefrom are caused either directly or indirectly through insufficient discrimination being made in their selection for the various classes of duty. There can be no excuse (except perhaps, economy) for using unsuitable brushes, as any reputable maker can supply carbon brushes graded to fit every known condition of working. What is commonly known as blackening of commutators is a condition which can be usually corrected by a suitable change of brushes. There is a growing tendency toward the wider use of plain or metal-capped brushes without bonding strips or cords, especially for low-powered motors. This cannot be looked upon as other than a retrograde step, as even if a number of brushes of the same design are used, the absence of any

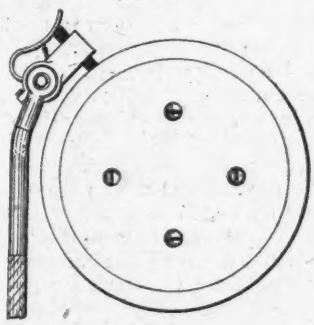


FIG. 12.

properly defined path for the brush current leads to all manner of trouble, and the inevitable heating which is set up destroys the tension spring, and insidiously weakens the holder at some slim part or other, such as rivet, pin, screw, &c. Greater tension, too, is required to ensure sufficient contact between the spring member and the brush; obviously, the life of the brush is considerably reduced thereby. For bonded brushes, probably the best method of amalgamating the flexible copper member with the carbon mass is to employ some binding medium which allows of the connection being made while the brush is in the plastic stage. The common method of soldering the bond to a metal cap or pin is unreliable, and the use of screw-clips and claws is equally bad, as, in addition, the practice renders a large proportion of the brush unusable. This detail is admittedly a weak point. There can be no excuse, however, for the existence of the many wretched devices which are to be seen at the other extremity of the brush-bond. For instance, the brushes of a certain standard 1,000-KW. machine were fitted with bonding cords which terminated in toy-like thimbles secured by $\frac{1}{4}$ in. Whitworth screws, the tapped hole in the thimble socket being insufficient in section to carry even a couple of full threads. The employment of separately attached terminals or thimbles

is bad and quite unnecessary, as suitable eyelets may be formed easily on the flexible bond itself by pressing or welding. Of the various methods in vogue for securing the eyelet end of the bond to the brush-holder or its spindle very few can be described as good, some are indifferent, the majority distinctly bad. Naturally, the ordinary threaded screw is largely used, and if due regard be paid to proper proportions, this method of making the connection provides a secure and efficient fastening. But one might, not altogether unreasonably, wish for a more facile and dignified way of securing a refractory brush-bond on a bottom set of brushes of a 1,000-KW. generator, than by means of a No. 5 B.A. round-head screw, the operator lying face upward with spinal column at a most unnatural angle. For this purpose such ridiculously small screws are altogether out of place; nothing smaller than a $\frac{3}{16}$-in. Whitworth, or equivalent thread, should ever be used, and loose washers should be avoided always. A good form of screw is shown at fig. 13. The type of pin plug (fig. 14) is used on some makes of motors, various kinds of socket being available; in one form a spring clip is attached to the brush-holder by means of screws, in others an extension of the holder itself is made to form a socket into which the said pin is introduced. To be really efficient a pin-plug for this kind of duty should have a bifurcated shank and be brazed or

FIG. 13.

FIG. 14.

FIG. 15.

welded to the flexible tape or cord, and fit into a correctly-drilled socket, one form of this attachment being shown at fig. 15. The shoulder at *a* is to prevent the pin from touching the commutator, as it not infrequently happens that the careless replacing of a brush-bond results in a badly-grooved commutator, when the connecting pin is unshouldered. Some makes of brushes are fitted with bonds of inordinate length, especially for the smaller sized motors; great care should, therefore, be exercised in fitting so as to avoid making accidental contact with the motor case, or fouling the brush tension spring or trigger. The writer has experience of many cases where unnecessarily long brush-leads have become welded to the motor frame, causing considerable damage and inconvenience, through being disturbed during cleaning operations.

Another fruitful source of trouble is the failure of the external insulation at the commutator end clamp-ring, as indicated at *a*, fig. 16. Usually, the breakdown is not primarily due to inherent defects or flaws in the insulation

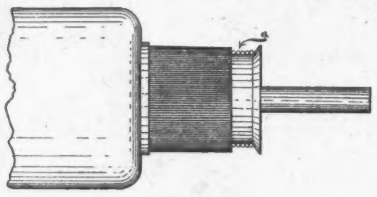


FIG. 16.

itself, but rather is the resultant effect of the time-honoured practice of binding with string or twine. The inconsistent practice of covering a fairly wide space of mica or micanite with cotton or hemp banding is really ridiculous. To argue that a serving of shellac solution is afterwards applied only aggravates matters, as the inevitable shrinkage that takes place renders the banding brittle and easily severed; moreover, the interstices between the several turns afford lodging places for dirt and grease. Further, to re-string an unwound band *in situ* is not an amateur's job, even were such a course recommendable, which it is not. This practice, still widely persisted in, is bad, mechanically and electrically, and it would seem, surely, that some better form of finish should not be beyond the resources of the progressive manufacturer. A satisfactory method was employed by one of the pioneer firms for a good many years, on fairly high-voltage machines.

The practice of "grooving" commutator bar insulation as a panacea for sparking troubles has enjoyed a very short-lived vogue, and perhaps rightly so. Doubtless, many cases of sparking have become amenable to some modification or other of this kind of treatment, but its application as a cure-all savours somewhat of the "tall order." Endless expedients have been devised and used with more or less success in the amelioration of sparking arising from *external* causes, and every plant attendant will have faith in his own particular pet palliative for administration in refractory cases. One might wish there were fewer proprietary nostrums on the market, as such so-called commutator compositions do more harm than good in ignorant hands, and it is by such that these substances are mostly used. Purely external sparking can be invariably traced to some well-defined cause or other, and when shorn of the profound mystification which usually surrounds the diagnosis of such affections, the disturbing factor oftener than not proves to be of an almost ridiculously simple character.

Given fair treatment a commutator will run for a surprisingly long time, even when it has become worn considerably out of truth. It is a mistake, however, unduly to

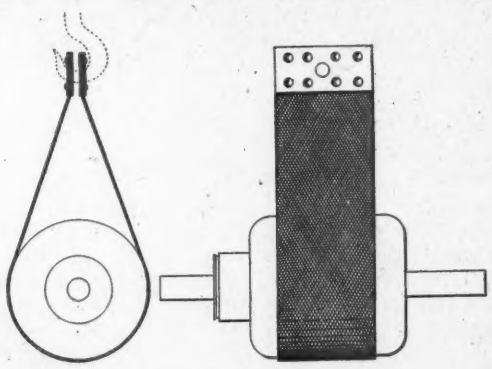


FIG. 17.

overrun a machine when in such a state. The best policy always in such circumstances is to have the commutator properly trued up before the inevitable mishap occurs. Of the two methods available—turning and grinding, it is pretty safe to say that neither has much, if any, advantage as regards the finished job over the other, all things else being equal. The turning of commutator metals demands the services of the skilled turner experienced on this particular class of work. On the other hand, a satisfactory job may be made by an unskilled hand (that is to say, one inexperienced at turning) with a good grinding machine. This is rendered possible by the employment of devices hitherto found only on the more expensive and fixed machine tools. Control of feeds and speeds is now obtained with micrometer-like precision, and the possibility of overrunning is eliminated by automatic reversing and stop-gear motion. One great advantage of the modern commutator grinder is that the commutator which is being operated upon also drives the grinder, usually by means of friction gear. With the older types of grinding machine the necessity for some external source of driving agent often added to the difficulties of overhauling a commutator. Of course, there are limits to the application of grinding *in situ*, especially in small sizes of motors—say, 20 H.P. and downwards. Improved methods of design and manufacture have rendered the withdrawal of an armature quite a simple matter, and no special appliances are necessary for its subsequent insertion between lathe centres. Once it is properly chucked, the actual work of turning up the commutator is performed with less expenditure of labour and time than if grinding were resorted to. When truing a commutator by turning, light cuts only should be taken, especially at the start, as the bulk of the cutting is on white stock, and mica quickly turns the edge of the tool. Heavy cuts, too,

have a tendency to spring the commutator bars and open the mica, thus presenting openings for the entry of metal dust and chips. A good average cutting speed is 90 to 100 ft. per minute, using a sharp V tool having slight *top* rake and set at centre of work. A good finish is obtained with "medium" and "fine" carborundum cloth. To prevent the lodging of cuttings between the commutator connnections a stiff paper covering should be previously attached in a suitable manner. The practice of swathing the armature winding at this part in canvas wrapping has much to recommend it, and has, in fact, been adopted by a few makers. Instead of the conventional rope sling commonly used for lifting armatures, a form of cradle, as shown at fig. 17 is better, as, with the latter, risk of damage to winding, commutator, &c., is practically non-existent. The writer has had the pattern illustrated made up of a suitable size of Gandy belting with patch eyelets as shown, for handling armatures up to 6 tons in weight.

The fitting of new brushes is an operation far too casually treated; so also the re-bedding of the whole of the brushes after skimming up the commutator is often neglected. Obviously, owing to the reduced diameter of the commutator, the brush face and commutator surface will not coincide. The initial correct shaping of the brush face is of the utmost importance, and new brushes should never be left to shape on the commutator unassisted; neglect of this measure results in scorching and discoloration of the commutator surface, which then requires restoration.

(To be continued.)

SOUTH AFRICAN MUNICIPAL ELECTRICAL ENGINEERS IN CONGRESS.

THE first annual Congress of the Association of Municipal Electrical Engineers (Union of South Africa) was held in Johannesburg, commencing on Monday, November 15th, and terminating on Saturday, November 20th, 1915. There were present the undermentioned municipal electrical engineers :—

M. McDonough, Bethlehem.
W. F. Long, Cape Town.
G. H. Swingler, Cape Town.
J. Roberts, Durban.
E. Poole, Durban.
J. H. Blatchford, Greytown.
J. R. English, Heilbron.
T. Millar, Harrismith.
J. H. Dobson, Johannesburg.
F. T. Stokes, Johannesburg.
E. T. Price, Johannesburg.
T. Jagger, Ladysmith.
T. C. Wolley-Dod, Pretoria.
B. Sankey, Port Elizabeth.
A. S. Munro, Pietermaritzburg.
F. Castle, Oudtshoorn.
N. D. Ross, Potchefstroom.
W. Bellad-Ellis, Queenstown.
R. Mortimer, Roodepoort.
W. Leonard, Standerton.
— Ward, Newcastle.
L. L. Horroll, Pretoria.
L. B. Proctor, Boksburg.
W. S. Guildford, Boksburg.

On Monday the delegates were welcomed by the Mayor (Mr. Norman Anstey) and the chairman of the Tramway and Lighting Committee (Councillor T. F. Allen). Prof. J. H. Dobson, general manager, Gas, Electric Supply and Tramways Department, Johannesburg Municipality, was unanimously elected President for the year, and in the afternoon the members visited the Rosherville power station of the Victoria Falls and Transvaal Power Co., returning to Johannesburg at 6 p.m.

On Tuesday morning the delegates visited the Crown mines, and were received by the general manager, Mr. A. J. Brett, and the underground manager, Mr. Simpson. The party went down the mine, visited the large underground electric pumping plant, and afterwards inspected the surface plant. In the afternoon, the President, Prof. J. H. Dobson, delivered his inaugural address, and was accorded a hearty vote of thanks by Messrs. T. C. Wolley-Dod, of Pretoria, and B. Sankey, of Port Elizabeth. Mr. W. F. Long, city electrical engineer of Cape Town, read a short paper, entitled "Some Notes on the Prevention of Corrosion in Condenser Tubes," and a lengthy discussion followed.

On Wednesday the Congress met at 10 a.m. at the Town Hall, and after informal business, Mr. John Roberts, borough electrical engineer, Durban, read a paper on "Tariffs of Prices for Electricity," which was fully discussed. In the afternoon the delegates visited the power station of the Randfontein Estates and Gold Mining Co., being welcomed at the mine by Mr. T. P. E. Butt, the chief electrical engineer to the company.

Next morning a paper on "Diesel Engines" was read by Mr. W. Bellad-Ellis, borough electrical engineer, Queens-

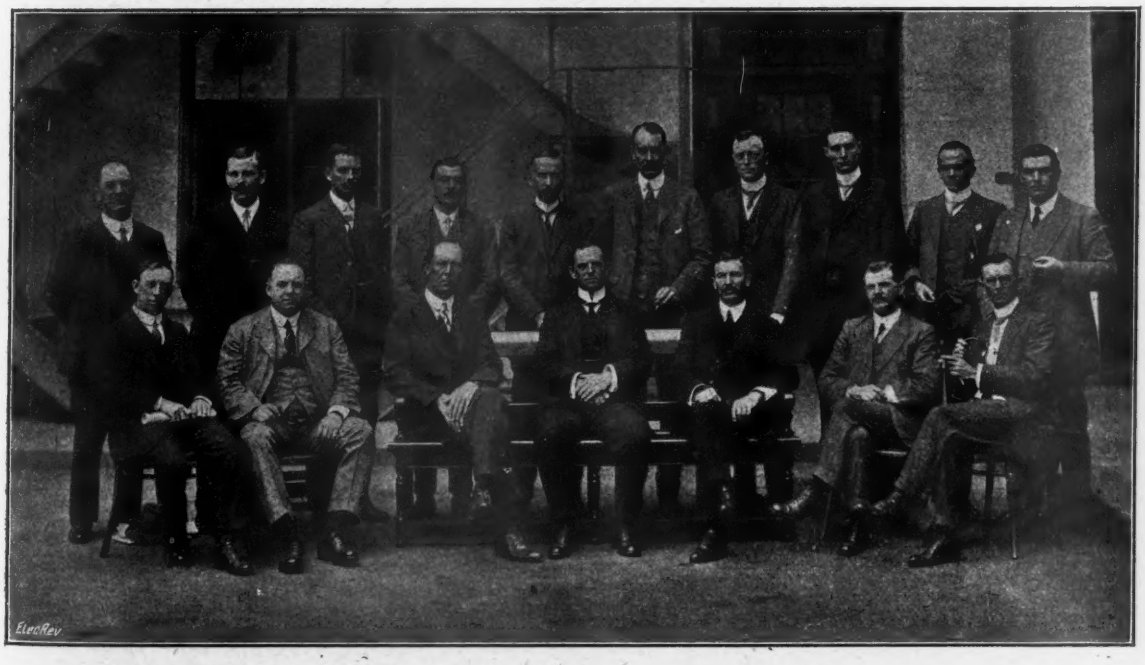


Photo.: Brittain, [*Johannesburg.*

A GROUP OF THE DELEGATES AT THE CONFERENCE OF THE MUNICIPAL ELECTRICAL ENGINEERS OF SOUTH AFRICA, Held at Johannesburg (S.A.).

BACK ROW.—M. McDonough, Bethlehem; J. R. English, Heilbron; T. Jagger, Ladysmith; T. Miller, Harrismith; J. Roberts, Durban (Member of Council); T. C. Wolley-Dod, Pretoria; B. Sankey, Port Elizabeth (Member of Council); E. T. Price, Johannesburg (Hon. Treasurer); F. Castle, Oudtshoorn; G. H. Swingler, Cape Town.

BOTTOM ROW.—W. Ballad-Ellis, Queenstown (Member of Council); F. T. Stokes, Johannesburg (Hon. Secretary); W. F. Long, Cape Town (Vice-President); J. H. Dobson, Johannesburg (President); A. S. Munro, Pietermaritzburg; W. H. Blatchford, Greytown; E. Poole, Durban. (*Names reading left to right.*)

town, and after discussion the members visited the various places of interest in the town; in the evening they were the guests of the S.A. Institute of Electrical Engineers at the Transvaal School of Mines and Technology, when Prof. J. H. Dobson read a paper entitled "The Distribution Plant of the Johannesburg Municipal Electric Supply System," receiving a hearty vote of thanks from the Council of the Institution for his valuable paper.

On Friday, further discussions on the papers read during the week took place, and in the afternoon the Johannesburg municipal power station and distribution system were visited, also the large municipal abattoirs.

The Congress was brought to a conclusion on the following day, Saturday, when informal business was transacted, and the additional officers and Council were elected for the ensuing year, making the complete list as follows:—President, J. H. Dobson; vice-presidents, W. F. Long, B. Sankey, John Roberts, W. Bellad-Ellis; hon. secretary, F. T. Stokes; hon. treasurer, E. T. Price.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

An Expansible Boring Cutter.

Messrs. Vislok, Ltd., of 2, St. Bride's House, Salisbury Square E.C., have recently placed on the market a new patented adjustable double-ended cutter for finishing holes in boring work, which is known as the "Gauge-all." The new cutter consists of two high-speed tool steel ends connected at the centre by special soft metal alloy. When, after the usual wear, it is necessary to increase the length of the cutter to its original dimensions, this is achieved by lightly hammering the alloy centre, which, being compressed,

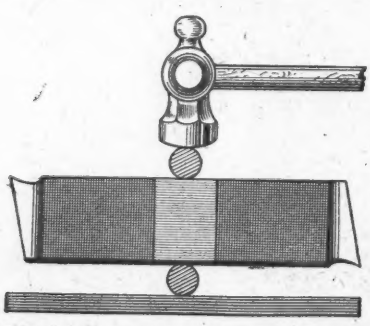


Fig. 1.—Method of Expanding Cutter.

forces out the steel ends. A U-shape iron or brass clip is placed round the alloy centre in order to facilitate the operation, and it will be noted that as the machine-man himself does this work, frequent visits to the tool room are dispensed with. A "Gauge-all" cutter with one centre has finished 200 holes, 3 in. by 10 in., in steel castings, and as new centres can be put in by the makers,

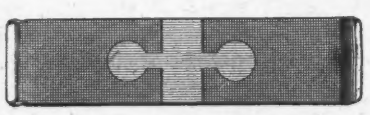


Fig. 2.—Cutter, Showing Alloy Centre.

its life can be still further prolonged. The ordinary cutter after about three visits to the toolsmith, has lost its nature, and therefore the new tool represents a great saving of tool steel—an indispensable commodity at the present time—and time, which is

Fig. 3.—"Gauge-All" Cutter Expanded.

always costly. We understand that the "Gauge-all" cutter has been thoroughly tested for a long time, mainly on steel castings, with most satisfactory results, and that in practice it has proved as stiff under a heavy cut as a solid steel cutter.

"Witton" Motor Starters and Controllers.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., has recently issued a new illustrated catalogue—"V section supplement"—dealing particularly with the numerous types of motor starters and controllers constructed by the company, which it is prepared to deliver either from stock or at short notice.

All kinds of "Witton" open, enclosed or semi-enclosed D.C. starters are stocked; this also applies to plain A.C. motor starters. These motor starters comprise adjustable three-phase resistances, without any automatic features, mounted somewhat similarly to those used in standard D.C. starters. The resistances are adjusted to pass approximately full load current on the first contact and thus to start motors against full load torque. "Off" contacts are provided. A spring return and "on" catch may be provided at a slightly increased price.

For starting three-phase squirrel-cage motors against loads not exceeding half full-load torque, "Witton" star-delta drum type

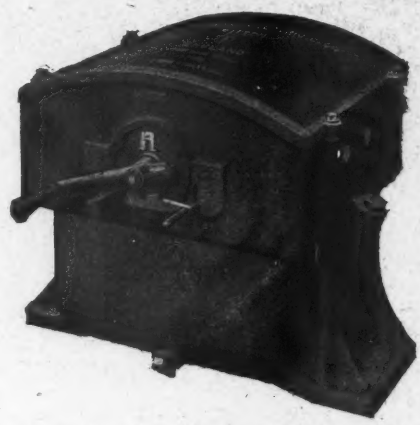


Fig. 4.—"Witton" Mistake-proof Auto-transformer Starter.

starters are to be recommended. These starters are suitable for motors taking a line current up to 50 amperes at 550 volts, three-phase. The "starting," "running" and "off" positions follow one another consecutively, so that it is impossible to go from the "off" to the "running" position without passing the "starting" stop.

Where squirrel-cage motors have to start against a greater torque than half full load torque, an auto-transformer starter should be employed; these starters comprise an auto-transformer with tappings giving a voltage of 40, 60, 70 and 80 per cent.

Fig. 5.—"Witton" Liquid Starter for Use in Mines, Flour Mills, Cement Works or Dust-Laden Atmospheres.

of the full line voltage, together with a change-over switch, operated by an external handle. The transformer can be oil-immersed if desired.

The well-known "Witton" liquid starter for continuous or alternating current motors is also listed, and we understand arrangements have been made to hold a large stock of finished parts to facilitate quick delivery.

In the case of extensions to existing motor equipment or new motor equipment in improvised factories and workshops, the "dockyard" and "factory" types of motor-starting panels are especially suitable. These panels consist of a Salford switch and fuse (two-pole for D.C. and three-pole for A.C.), one ammeter, totally enclosed in the dockyard and open in the factory type, and one D.C. or star-delta starter, totally enclosed in the dockyard

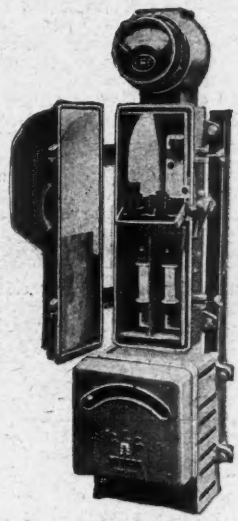


FIG. 6.—FACTORY TYPE MOTOR STARTING PANEL WITH DOOR OPEN, SHOWING FUSES.

and semi-enclosed in the factory type. The panel is simply bolted in position on site and connected to the motor by leads in the usual way.

For the control of small cranes and in other situations where space is limited, "Witton" 1 AR size controllers are suitable.

In addition to the foregoing, other controllers and controller resistances are listed, as are automatic motor starters, ironclad reversing switches, shunt regulators, main regulators, multiple switch starters, single-phase motor starters, &c.

Horn-Gap Fuses.

In the *Electrical World* for December 11th, Mr. E. A. Dillard describes methods which he has found satisfactory for the protection of small sub-stations against overload and breakdown of apparatus with high-pressure fuses. He prefers annealed copper wire for the fusible metal, though other metals would serve, and has found it easy to calculate the time in which a fuse will blow under given conditions, but not so easy to ensure the speedy clearing of the arc that follows.

The best shape of horn was found experimentally; straight horns like portions of the letter V were not so good as horns

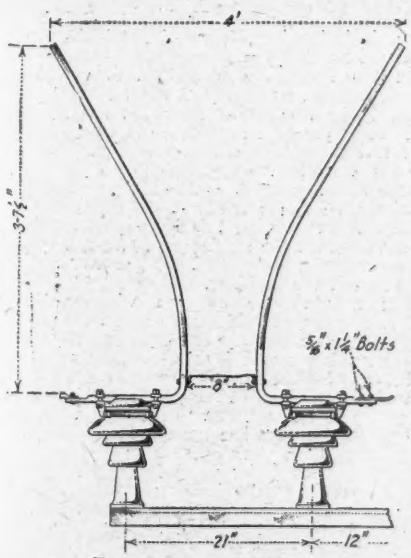


FIG. 7.—HORN-GAP FUSE.

curved as in the accompanying figure, which shows the horn-gap fuses used on overhead circuits at 22,000 volts; with these horns the arc was opened in half the time required with horns of other shapes.

The horns were made of galvanised-iron pipe, provided with clamping bolts at the base for the fuse wire, which was also wrapped round the horns, but enclosed fuses were found more satisfactory, the fuse-wire being enclosed in a fibre tube surrounded with a glass tube capped at one end with a heavy brass terminal. On fusion taking place, the arc vapours are violently expelled from the open end of the tube, and the arc is quickly broken without damage to the holder.

Electric Hot-Pad.

The HOTPOINT ELECTRIC HEATING CO., of 38, Poland Street, Oxford Street, W., have introduced a new flexible metal hot-pad—the "El Comfo"—constructed of nickel-plated metal with a removable eiderdown cover, and sufficiently flexible as a whole to bind round an arm or leg or fit to the shape of the body.

A special feature is the provision for temperature regulation. An even temperature can be maintained between 100° and 200° by

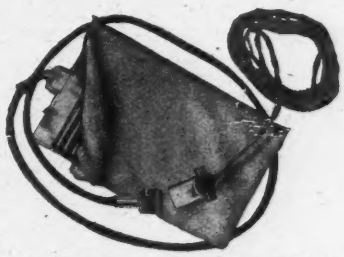


FIG. 8.—"EL COMFO" FLEXIBLE HOT-PAD.

means of a thermostatic cut-out arranged inside the apparatus, while the temperature limit is fixed by a small switch lever at one end of the device. It is claimed that owing to the automatic heat control, some five hours' service can be obtained for ½d. The

FIG. 9.—ALUMINIUM HOT-PAD.

apparatus is supplied with 4 ft. of specially reinforced flexible to connect to 6 ft. of ordinary cord and measures 10½ in. by 6½ in. by ½ in. thick.

A non-flexible aluminium hot-pad is also supplied of circular disk pattern, with one side convex and the other concave to suit body curves. The temperature arrangements and covering are similar to the preceding type; the apparatus is 8 in. in diameter and weighs 1 lb. The heating elements are guaranteed for two years for the flexible and for five years for the non-flexible type.

Japanese Electro-chemical Works.—H.M. Vice-Consul at Osaka reports that a company has been formed in Osaka, with a capital of 350,000 yen (about £35,700 at par), for the manufacture of caustic soda by the electrolytic process, and is going to erect a factory in Kyushiu, where hydro-electric power is fairly cheap. The machinery is to be Japanese. As a by-product bleaching powder will be obtained, and an output of 300,000 lb. of caustic soda per month is spoken of.

Renumbering of Patent Specifications. — The Patent Office announces that in order to give the public the advantage of having abridgments of specifications up to date while retaining their numerical sequence, applications for patents made subsequent to 1915 will be given new numbers when their complete specifications are accepted, or become open to public inspection before acceptance. The new numbers will start with No. 100,001 (without any indication of date), and will supersede the original application numbers in all proceedings after acceptance of the complete specifications. It is intended in future to issue abridgments of specifications in the illustrated official *Journal* a few weeks later than that in which their acceptance or publication is advertised, so that they will be available for search purposes soon after the printed copies of the specifications are on sale; but, until the system is fully in force, they will only be issued when there are sufficient to make up a full sheet of 16 pages. The present series of abridgments will run concurrently with the new series in the *Journal* until April, 1917, when it will be entirely superseded.

D

THE IGNITION OF EXPLOSIVE GAS MIXTURES BY ELECTRIC SPARKS.

By J. D. MORGAN, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Birmingham, December 18th*, 1915.)

THE ignition of an explosive gas mixture by a spark is commonly considered to depend upon the communication of heat from the spark to the gas. When approaching the subject it is natural to suppose that the ability of the spark to ignite the gas can be expressed in terms of the heat energy of the spark. On examining the subject experimentally, however, a suspicion is soon created that ignition depends partly, if not entirely, upon some cause other than heat.

Assuming that heat alone when accompanied by sufficient temperature is capable of causing ignition, it would apparently be right to suppose that the mode of producing electric sparks containing sufficient heat could have no effect upon the igniting property of such sparks. This, however, is not found to be the case.

Prof. Thornton has shown that a greater amount of energy is required to produce an igniting spark by an alternating

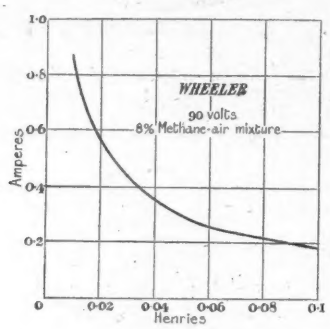


FIG. 1.

current than by a continuous current; and the relationship between the number of volts and amperes in the circuits immediately prior to the production of the sparks differs in character in the two cases. This fact is in itself sufficient to prompt the question: Does ignition depend upon some factor other than heat? A variety of experiments suggest a reply. If an iron wire heated by an electric current (continuous) be held over the disk of a charged electroscope, it will be found that when the wire first becomes visibly hot there is no effect upon the electroscope and gas cannot be ignited. On gradually increasing the current a condition of temperature is attained at which the electroscope steadily discharges. It is at this temperature that ignition occurs. Mr. J. R. Thompson has found that it is possible to ignite a cold explosive mixture by the incidence of X-rays on a platinum surface in it.

Where a hot wire or spark is the source, ignition only occurs when ionisation is produced, and ionisation alone without heat has been found to be capable of causing ignition.

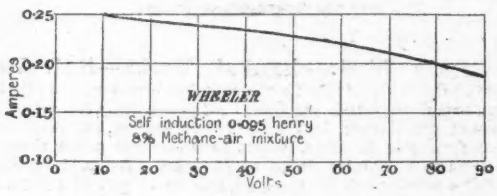


FIG. 2.

Ionisation accompanies the common electrical methods of ignition.

It is well known that gas mixtures are only combustible when the proportions lie within certain limits. These limits, for methane and air, have been carefully worked out by Dr. Wheeler, and the least single igniting spark for mixtures between these limits has been investigated by both Wheeler and Thornton. Mixtures of methane and air containing less than 5.6 per cent., and more than 14.8 per cent. of methane are incapable of ignition. The most sensitive mixtures lie between 7.5 per cent. and 9 per cent. of methane.

A common method of defining the least spark which will ignite a given gas mixture is by specifying the number of volts and amperes, or the number of amperes and the inductance in the circuit prior to the formation of the spark. On the assumption that this gives a measure of the ability of a spark to ignite a gas (or the "incendivity" of the spark), the validity of the method has been rightly questioned. For both inductive and non-inductive circuits there seems to be no sufficient reason, as will be explained later, for the assumption that the energy associated with a circuit prior to sparking can be regarded as a measure of the incendivity of the spark. Nevertheless, there is a practical value in curves showing the relationship between the number of volts and amperes or amperes and inductance in circuits which when broken give rise to sparks capable of igniting a given gas mixture, for they indicate conveniently the practical conditions under which dangerous sparking becomes possible.

The character of the alternating-current curves is different from those for continuous current, and for a given voltage the amount of the current is always higher. Fig. 1 shows how at a fixed voltage (90 volts) the least current capable of producing an igniting spark in an 8 per cent. mixture of methane and air varies with the inductance of the circuit. It is interesting to note that in an inductive circuit at relatively low voltages the current varies but little over a wide range of voltage variation. An example is shown in fig. 2. A similar condition is found in fig. 4. The curves given in figs. 1 and 2 show that the amounts of voltage and current, or current and inductance, capable of producing dangerous sparking are comparatively small, and emphasise the necessity, already well known, of adequately safeguarding electrical apparatus to which explosive gases are accessible.

The experiments upon which the curves in figs. 1 and 2 depend were performed with the aid of single sparks. The author finds that a single spark, which when repeated slowly will not ignite a gas, will after a more or less definite interval produce ignition when repeated rapidly. The element of time seems to him to be a factor of importance in ignition phenomena. If, instead of a single break device, a vibratory make-and-break device (such as the trembler of a bell) be employed, it is found that the ability of a given spark to ignite a gas mixture depends upon the duration of the sparking as well as upon the circuit conditions recorded in the investigations above described.

Fig. 3 shows a typical result following the use of a trembler spark in an explosive atmosphere consisting of a 10 per cent. mixture of coal-gas and air. The current was approximately 0.4 ampere throughout the range of the experiment. At 9 volts ignition was obtained instantly. On reducing the volt-

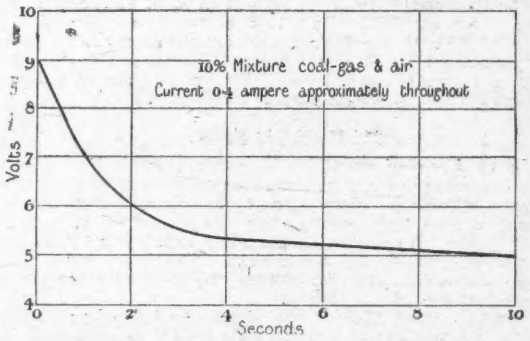


FIG. 3.

age to 7 a single break-spark would not ignite the gas, even when repeated as rapidly as hand-manipulation would permit; but when the trembler was allowed to vibrate normally, ignition due to the trembler spark occurred after one second. At 5 volts ignition occurred after ten seconds. This fact appears to be of practical importance in connection with that system of bell signalling commonly used in mines, in which the circuit is closed by the application of a piece of iron to a pair of bare wires. Sometimes an old file or a knife is used, and whatever be the implement employed the surface is usually rough. In drawing this implement across the wires there is not obtained the single spark of carefully maintained laboratory apparatus, but a rapid succession of sparks approximating to that of the trembler.

Reverting now to the question whether the measure of the circuit volts and amperes, or amperes and inductance, can be regarded as a measure of the incendivity of the spark, Prof. Thornton has stated that the energy of a break-flash (referred to sometimes in this paper as a single spark) is proportional to the power of the circuit and is equal to $\frac{1}{2} L i^2$, where i is the circuit current. In a recent leading article, the ELECTRICAL REVIEW * has gone a step further. Arguing from Prof. Thornton's work and basing its calculations specifically on certain curves by Dr. Wheeler (of which fig. 1 is one), it is stated that the igniting power of a break-flash depends on the $L i^{1.54}$, or approximately the $L i^{3/2}$, of the circuit. Finally, it is stated that for every gaseous mixture there is a constant value of the product $L i^{3/2}$ beyond which the break-flash will be capable of igniting the mixture. This is an interesting deduction, but the truth does not seem to be expressible in such a simple form. Igniting sparks can be produced in practically inductionless circuits carrying but a few amperes. These sparks, which may be termed "hot-point" sparks, are not included in an expression based on inductance.

* ELECTRICAL REVIEW, Vol. 77, p. 65, 1915.

When a pair of contact points in a non-inductive circuit are separated so that an arc is maintained between them, it is true that the product $v\,i$ is a measure of the power of the arc. The value of $v\,i$ is not necessarily the same during arcing as when the contacts are together, and there is no reason for assuming them to be the same when the arc is only of momentary duration. Therefore $v\,i$ prior to sparking is not a measure of the power of a hot-point spark. Further, in non-inductive circuits carrying the same power, both igniting and non-igniting sparks can be produced by simply altering the shape or material of the contacts. Again, when the circuit is inductive and the above effect does not enter or is negligible, then the energy which produces the spark on separating the contacts is expressed by $\frac{1}{2}Li^2$. With the same energy either igniting or non-igniting sparks may be produced according to the shape or material of the sparking points.

As already indicated, curves connecting volts and amperes, or amperes and inductance, in the circuit are useful as giving a general idea of the magnitudes involved in the production of igniting sparks, but caution must be exercised in using them, since (1) a variation of the size or material of the sparking points is attended by an alteration of the value of the circuit current required to produce an igniting spark, and (2) the incendivity of a spark depends to some extent upon its duration.

The general conclusion to which the author has been led by a variety of experiments on the electrical ignition of gases is that it is necessary to distinguish between the energy which produces a spark and that quality of the spark termed by him "incendivity," which enables the spark to cause ignition, and that the magnitude of the one is not a measure of the other, although there may be a more or less regular relation between them when certain physical conditions are kept constant. Ignition seems to depend on the ionisation caused by the spark. During the interval of sparking the ionisation may be rapidly dissipated or neutralised. If the neutralising action predominates there is no ignition of a gas mixture. If there is little or no neutralising action, ignition occurs immediately. Between these two limits there are a variety of intermediate conditions, which apparently account

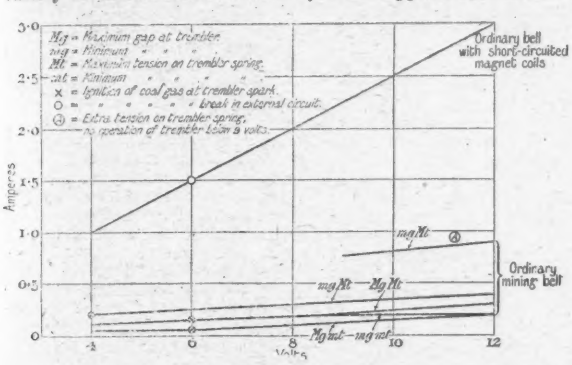


FIG. 4.

for the delay of ignition indicated by fig. 3, and much of the great irregularity that is often experienced in experimental work on this subject.

Enclosed Apparatus.—The effect on an explosion of the shape of the gas containing-chamber is not sufficient to be of any practical importance in the design of a case. However, if the shape is such that the case virtually comprises two or more communicating compartments, then an explosion initiated in one of them might spread to and produce destructive effects in the other; and a given gas mixture which explodes harmlessly in a motor case when the armature is at rest might explode with sufficient violence to wreck the case when the armature is in motion. These phenomena are quite well known in connection with the study of gas explosions. The increased pressure in the first is due to compression prior to ignition, and in the second is due to turbulence. In the design of protective cases for electrical apparatus it is necessary (1) to avoid intercommunicating chambers or chambers with partitions so arranged that it is possible for an explosion in one chamber to compress the gas in the other before igniting it, and (2) to construct the case so that it will withstand the increased explosion pressure due to turbulence. A motor which successfully resisted an internal gas explosion when at rest had its cover blown off by an explosion when the motor was in motion. At first sight this does not appear to agree with what is known of turbulence effects; but the explanation is probably that when an explosion occurs in a chamber in which the cooling surface is relatively large, turbulence may produce not only an increased rate of explosion but also an increased maximum pressure. A further fact which might have a practical bearing upon the design of covers is the character of the internal surface, if the configuration involves restricted passages. A rough surface has an accelerating effect both in dust and gas explosions, probably due to turbulence. Whether this effect is appreciable in closed chambers does not appear to be definitely known, but in tubes the effect is very marked.

Mine Bell-circuits.—The signal bell-circuits employed in mines commonly comprise a pair of bare wires connected to a trembler bell and battery. A signal is given by connecting the wires with the aid of a metal instrument. The bare-wire system has much to commend it on the score of simplicity and convenience, but latterly it has become the subject of much suspicion, especially since the Senghenydd disaster in 1913. Suggestions have been made to abolish bare-wire circuits and employ enclosed switches arranged at suitable intervals along insulated circuits, but the inconvenience of this is sufficiently evident to make it clear that miners will not abandon the bare-wire system unless it is shown to be irremediably dangerous. The facts appear to be that the system is not seriously risky and that what risk does exist can easily be removed.

The spark at the trembler of a bell is more dangerous than the single break-spark which occurs on the bare circuit when a signal is given. To avoid the use of a trembler it has been proposed to use single-stroke bells; but the trembler bell is apparently preferred by miners as the liability to mistake in the interpretation of a signal is less with the trembler than the single-stroke bell.

Danger of gas ignition at the trembler has been minimised by the use of an enclosing case, and the risk due to the spark in the external circuit has been tolerated partly for the reasons that such spark is supposed to be comparatively harmless and that the ventilation of the mine is sufficient to prevent the accumulation near the wires of an explosive mixture. Laboratory investigations show that, using a bell of the ordinary type, the break-spark can be not less dangerous than the trembler spark. If it is deemed necessary to enclose the trembler, there is no justification therefore for disregarding the break-spark. The first necessity is to abolish the break-spark or reduce it to a harmless dimension, and the second is to render impossible such a variation of the bell adjustment as would enable a dangerous break-spark to be produced.

The results of tests by the author on a mining bell in an atmosphere of coal-gas are shown in fig. 4. One object was to find the variation of current in the bell circuit with variation of voltage, and the manner in which these variations are affected by alterations of the bell adjustments. The other object was to find with what voltage and current ignition could be obtained both at the trembler and the break or contact in the external circuit. By adjusting the movable contact-screw at the trembler so as to produce the minimum spark-gap when the armature was vibrated by the magnet, and reducing the resistance of the armature controlling-spring to the minimum, the relation of volts and amperes indicated by mg.mt. was found. At 4 volts the current was 0.1 ampere, and at 12 volts the current was 0.2 ampere. Retaining the same tension at the spring and increasing the trembler gap to the maximum, the curve Mg.mt. was obtained. With this adjustment the current is 0.05 ampere at 4 volts and 0.2 ampere at 12 volts. Keeping the gap at the maximum and increasing the spring tension to the maximum at which the bell could be actuated with a pressure of 4 volts, the relationship between volts and amperes is given by the curve Mg.Mt., in which the current rises from 0.1 ampere at 4 volts to 0.3 ampere at 12 volts. Still keeping the maximum tension, but adjusting the gap to the minimum, there was obtained the curve mg.Mt., which varies from 0.2 ampere at 4 volts to 0.4 ampere at 12 volts. A much higher current could be passed through the system by largely increasing the spring tension, but the bell could not then be actuated at a pressure below 9 volts. The result is shown in the short upper curve, which rises from 0.75 ampere at 9 volts to 0.9 ampere at 12 volts.

Repeating the above experiments in order to determine the conditions necessary for ignition of a coal-gas mixture, it was found that in the tests corresponding to the first three curves ignition could be obtained at 6 volts, but not lower; whereas when the spring tension was increased and the gap diminished as above stated, ignition could be obtained at 4 volts. When the gas could be ignited at the trembler spark it could also be ignited (although sometimes only after a number of trials) at the single break-spark. In these tests, therefore, both sparks were equally dangerous. The system which could be made to operate safely below 6 volts could be rendered dangerous by altering the trembler spring.

The above remarks are only true for coal-gas. It may be rather severe to test a mining installation in coal-gas, but if it can stand the coal-gas test it is abundantly safe in methane. An ignition test made by Dr. Wheeler on the above bell showed that with the armature fixed and the trembler contacts touching (a condition which gives the largest break-flash), the least current required to produce an igniting break-flash in an 8 per cent. mixture of methane and air was 0.26 ampere at 25 volts. An oscillogram of the current taken by the bell while ringing has been kindly supplied by Dr. Wheeler and is shown in fig. 5.

To ascertain whether a large reduction in the strength of the magnet coils would reduce the capability of the trembler and break-sparks to ignite coal-gas, a pair of weaker coils was arranged in conjunction with a vibrating armature contained within a small explosion chamber, the armature being controlled by a spiral spring instead of the flat or blade spring usually employed. In all cases the current values are higher and the sequence of the curves is slightly different from that of the bell tests. With minimum gap and minimum tension, ignition was first obtained both at the trembler and the

break at 6 volts. With the other adjustments ignition was obtained at 4 volts. It follows, apparently, that it is useless to reduce the inductance of the circuit to avoid dangerous sparking unless the value attainable by the current is also reduced. In his report Dr. Wheeler remarks upon the desirability of making the resistance as high as possible, and the above experiments support this conclusion.

An obvious deduction from the foregoing is that for safe working the maximum voltage should be kept as low as possible. In the author's opinion, the value permitted by the Home Office regulations, namely, 25 volts, is much too high. Also the internal resistance of the batteries should be high in order to avoid a relatively large current in the event of an accidental short-circuit. Further, some additional precaution should be taken to abolish the spark or to reduce it to negligible dimensions.

A variety of expedients have been devised. One, well known to telegraphic engineers, consists in the arrangement of a non-inductive shunt of comparatively high resistance across the ends of the magnet windings. This diminishes the trembler spark and probably reduces the break-spark. A condenser across the trembler gap improves the conditions at the trembler, but does not remove the danger from the external circuit. Another device consists of a short-circuited winding or layers of tin-foil between the magnet windings for the purpose of reducing the energy available for sparking

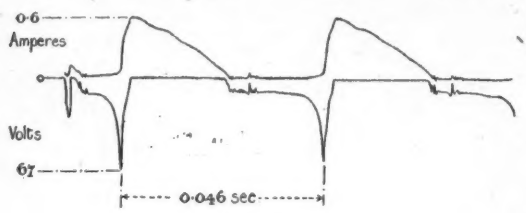


FIG. 5.

at the gap or break. Layers of tin-foil were wound in the magnet windings of the coils used for the tests recorded above, and it was found that whilst they increased the voltage required for ignition at the trembler from 4 to 6 in the Mg.mt. curve, no improvement was found at the break-spark of the external circuit.

An arrangement which has been found to give good results at both the trembler and the break is shown in fig. 6. The action at the trembler is the reverse of the ordinary action.

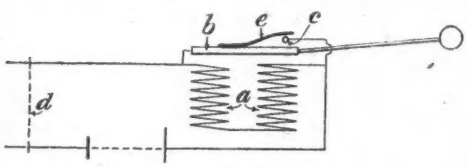


FIG. 6.

Instead of interrupting the circuit, the trembler short-circuits the magnet. The magnet windings are indicated by *a* and the spring-controlled armature by *b*. One end of the armature is connected to one end of the magnet coils, and the fixed contact *c* is connected to the other end. When the external circuit is closed as indicated diagrammatically at *d*, the magnet is excited and the armature is attracted by the same. Near the end of the movement a spring blade *e* on the armature touches the fixed contact *c* and short-circuits the magnet. By means of its spring the armature is returned, and the parts *c* and *e* are separated. The action is then repeated and a vibratory motion of the armature is obtained. Only a very minute spark is produced at the trembler, and this is entirely negligible. The intensity of the single break-spark at *d* is not reduced, however, to the same extent, and although it is much less active than when the ordinary trembler construction is used in the bell, it is possible to produce ignition of an explosive coal-gas mixture.

The mining bell above referred to was converted, without altering the magnet coils, to correspond to fig. 6, and the result of a test is shown by the top line in fig. 4. It will be observed that the current taken by the bell was very considerably larger than that by the normal bell. At 4 volts the current was 1 ampere, and at 12 volts it was 3 amperes. Notwithstanding the relatively large amount of current, no ignition of a coal-gas mixture could be obtained with any voltage at the trembler, but ignition could be obtained with 6 volts at the external break. By suitably proportioning the magnet windings and inserting a resistance between the battery and the bell, the current can be reduced to something of the same order as that required for an ordinary bell, and in that case the external circuit would be rendered quite safe.

Notwithstanding the improvements obtainable by devices such as those above described, the complete solution lies, in the author's opinion, in a suitable relay system. By using a small relay arranged to be actuated by a 4-volt battery, he obtained perfect operation of the bell with a current of 0.1 ampere in the relay circuit. Sparking in the external circuit of the relay was quite insignificant, and no ignition of coal-gas could be obtained. It was necessary to increase the relay current to 0.6 ampere before ignition could be produced. At the relay contact the condition was the same as in the external circuit of an ordinary bell; but it is obvious that this could be avoided by the use of a condenser or non-inductive resistance at the relay contact and the employment of a short-circuiting trembler at the bell. A similar experiment to the foregoing was performed by Mr. Watts* with similar results. Under laboratory conditions there is no difficulty in rendering a bell system safe on the lines above indicated, and there appears to be no reason why the same conditions cannot be realised in a practical apparatus suited for mining conditions.

Conclusion.—The opinion has already been expressed above that the Home Office regulations limiting the highest permissible voltage in bell signalling systems to 25 cannot secure safety, as the figure is obviously too high. If it is desirable to fix a limit, the figure should be reduced to 6. With the adoption of a relay system this lower figure is practicable. The fixing of a voltage limit is not, however, sufficient in itself to ensure safety. There should be added the condition that sparks produced in the system should not be capable of igniting a specified mixture of methane and air, as this result is easily obtained with a relay.

DISCUSSION.

Dr. KAPP said that the subject of the paper was of extreme practical importance, but also of considerable difficulty. The author said "the energy associated with a circuit prior to sparking can be regarded as a measure of the incendivity of the spark"; but he submitted that not the energy alone, but also the means employed to dissipate it should be regarded as essential factors of the problem. When the current was interrupted the stored energy $\frac{1}{2} L i^2$ must go somewhere; it was questionable whether a condenser was practicable, and the use of an inductionless shunt to the exciting circuit of the bell was objectionable, because it increased the line current and, therefore, the sparking at the bare mine wires when bridged. The author's device of working the bell on what might be called an inverted principle seemed much preferable, and, to judge from the results of tests given in the paper, this principle was quite successful. Thanks to the author's ingenious device, the problem might be considered solved at the bell; but what about the danger of incendivity of the spark when contact was made and broken at any point along the two bare wires? No doubt a relay system would be a solution, but was it robust enough for the rough usage of a mine? He suggested that perfect safety might be obtained in a simpler manner by distributing condensers along the signal wires, and especially putting one at the tail end. This expedient had the advantage that it could be applied to any existing installation, and at very little cost, by using Mansbridge condensers. To show what the effect of thus ballasting the line with condensers would be, he had calculated the sparking conditions of a particular line a mile long, and consisting of two wires spaced 10 cm. apart. Its inductance was 2.6 millihenries, and its capacity a little over one-hundredth of a microfarad; resistance 20 ohms. If a current of 1 ampere were broken at the tail end, there would be an oscillation with a periodic time of 34 microseconds, the damping effect of the resistance being very small. During the fraction of a second that it took to remove the iron bar by which the signal had been given, there might be some thousands of oscillatory sparks passing between wire and bar. The E.M.F. at the moment of zero current would be 440 volts, and the maximum power, which occurred at the time of 4 microseconds after the break, was 200 watts. It was true that the total energy stored in this so-called "non-inductive line" was only about 1,300 microjoules, but the frequency was extremely high, and the author had told them that high frequency increased the danger. It was, therefore, quite conceivable that an ampere broken anywhere on this line might produce a dangerous spark. Now let them ballast this line with only 10 mfd. in all, evenly distributed, say, in quarter-mile sections. The frequency of the spark now decreased to 1,000 per sec., the maximum voltage to 4.4, and the maximum power, which occurred 125 microseconds after breaking, had gone down to very little over 2 watts. These figures were well within the limits set by the author.

Dr. C. C. GARRARD said Mr. Morgan had thrown a very considerable amount of light upon a number of obscure points in the question of the ignition of firedamp in collieries. His own view was that all electric sparks in collieries should be regarded as dangerous and should be enclosed in suitable boxes. In his opinion, a switch-box for use in a colliery should be both explosion-proof and flametight, *i.e.*, capable of withstanding any internal explosion without emitting flames or sparks which would ignite an explosive mixture outside the box. There were two other points which Mr. Morgan had not touched on. The presence of ethane increased the liability of explosion of methane and air mixtures. The presence of coal dust was also of importance. It had been found that with sufficient coal dust an explosion could be caused by sparks in an atmosphere containing only ½ per cent. of gas.

* ELECTRICAL REVIEW, Vol. 76, p. 30, 1915.

These facts strengthened the argument for the total abolition of open sparking in collieries. The remarks of Mr. Morgan as to how ignition depended on the ionisation caused by the spark were very illuminating; he was also much interested in the possibility of the violence of an internal explosion being increased by a portion of the explosive mixture within the box becoming compressed before ignition, due to an explosion in another part of the same box. He could confirm that by means of a relay combined with a condenser it was possible entirely to suppress the spark at the signalling wires. But if anything should go wrong with the adjustments of the relay, sparking might still occur at the signal wires. He was, therefore, inclined to think that a mechanical pull arrangement, with the contact-making device enclosed in an explosion-proof and flame-tight box, would eventually replace the bare signalling wires hitherto used.

Dr. RAILING, referring to the apparent disagreement between those authorities who asserted that the process of ignition was entirely electrical or entirely thermal in its origin, said that possibly both were right. It was possible that some sort of atomic turbulence was necessary to all chemical actions between atoms having an affinity for each other, and that this atomic turbulence could be set up either by electrical or thermal agencies.

Mr. E. A. WATSON wrote that the experiments quoted by the author seemed to show that the problem whether a given spark would or would not ignite an explosive mixture was not altogether a question of the total amount of energy available. On the thermal basis of ignition it was comparatively easy to see how it might be possible for there to be a limiting value to the energy below which ignition would not occur. If they considered a small quantity of hot burnt gas surrounded on all sides by a shell of cold unburnt explosive mixture, ignition would only occur if the heat liberated by the burnt core were sufficient to raise the surrounding shell to its ignition temperature. The smaller the volume of the hot core the less would be the ratio of the volume of core to the area in contact with the surrounding shell and the greater the cooling effect. They should therefore expect that before ignition of the whole charge could occur it would be necessary to raise a definite volume of gas to the ignition point, and this would, of course, require a definite amount of energy. They should, further, expect that the value of the minimum energy required would be affected by the pressure and temperature of the explosive mixture before ignition. The fact that although one spark would not ignite a given mixture yet a rapid succession of sparks would do so, might quite well be due to the heating of the mixture by the energy liberated. In this connection it was interesting to note the very large range of variation in the energy of the spark given by different makes of magnetos on the market, all of which might be said to give satisfactory ignition of the explosive charge. The output of a magneto varied considerably with the speed, but taking a standard speed of 500 R.P.M. it was found that the energy per spark given by various single-cylinder magnetos varied from 0.007 joule for a small American magneto to as much as 0.065 joule for a high-class English machine intended for very similar duty, *i.e.*, a range of output of very nearly 10 to 1. It would therefore seem that either the one machine must be unsatisfactory or the other must be needlessly powerful. The problem, however, was complicated, as much probably depended upon the speed of the engine, it being quite conceivable that an amount of energy which would be sufficient for a slow-speed engine might be inadequate for a high-speed one. It was well known that a substantial increase in B.H.P. might be obtained in most large high-speed engines by igniting the charge simultaneously at two points in the cylinder, but there appeared to be no data available to show whether an increase in B.H.P. might be obtained by increasing the energy at the sparking plug.

Mr. S. F. WALKER wrote that 25 years ago the question arose whether the spark on breaking circuit after ringing by pressing the naked iron wires together would ignite gas; he made some very exhaustive experiments, from which it appeared that there was very little chance indeed of ignition taking place. The signals which he fitted up in mines almost universally employed single-stroke bells, with which the danger of ignition of gas by sparks was considerably reduced. For complete immunity, he thought naked wires would have to be given up, and that connection for ringing would have to be made in explosion-proof cases. About 35 years ago he adopted the relay system at the Nunnery Colliery, Sheffield, but for a totally different reason. A signal was fixed on a very long engine plane, which was also very wet, and the leakage was so great that batteries would only keep up to their work for a very short time. He fixed a relay and put six cells only to work it, connecting the remainder in the local circuit with the bell. The arrangement was completely successful. The leakage was reduced within reasonable terms, and the signals remained loud and strong all the time.

Burnley.—A special meeting of Corporation employés, including tramway workers, has declined the offer of the Council of an increase of 5 per cent. for men earning 30s. and under, and an increase of 1s. per week for those earning over that amount. It was decided to press the original demand for a 3s. increase to the utmost limits.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The A.E.G. Meeting.

In closing this correspondence, I see another anonymous contributor, siding with "Anti-Humbug," accuses me of "obfuscation." Surely, the boot is on the other foot. I replied to the charge that it was as much as the existence of the E.C.A. was worth to tackle the problem of trading with enemy concerns such as the A.E.G. My contrary contention has now been fully conceded by "Anti-Humbug," and I am satisfied.

Allow me to repeat that the E.C.A. does represent the bulk of the capital invested in electrical contracting in this country, and its members are not guilty of the crime specified.

H. Marryat.

Chiswick, *January 3rd*, 1916.

Salaries in Power Stations.

In connection with the alleged shortage of power station assistants, it would appear that at last the Government are beginning to realise that electricity works, like railways and collieries, are of vital importance to the maintenance of industry, and in particular to the production of munitions of war. Now that the important fact has been brought home to the Ministry of Munitions, it is to be sincerely hoped that a businesslike policy will be adopted in regard to any matters connected with the supply of electricity and questions affecting electricity works employés, etc.

It will be agreed that electrical station men as a class have responded nobly to the call and offered their services for the Forces or as skilled engineers on munition work, although in many cases managers and committees have refused to sanction any temporary depletion of their staffs. The result has been, of course, that some of the more patriotic spirits have resigned in order to join the Forces, whilst others again have left to take up more attractive and better-paid positions in other stations or with firms engaged on Government work.

In order to stem the tide of affairs, chief engineers and managers have in many cases offered paltry war bonuses and an enamelled badge to the members of their technical staffs, with a view to compensation for the increased cost of living, and possibly to imbue the men with the importance of their position in the community. The bait has been swallowed in too many cases, but lately there appears to have been more real difficulty in getting men for charge engineer and switchboard duties, and whilst some engineers and managers have in a businesslike manner offered a living wage and secured competent men, others (judging by their advertisements) still try to continue the "penny wise and pound foolish" policy of employing underpaid technical assistants, and, to crown all, actually wonder why they can't get men!

In several instances the reprehensible practice of promoting comparatively untrained switchboard attendants to the position of "charge engineer" has been resorted to, no doubt, with a view to economising on the salaries item; but the results of such a policy are apt to be reflected in the shape of increased generating costs, particularly in regard to the steam side of the plant.

One hesitates to think that a power station in some fairly important industrial and munition area, containing some thousands of kilowatts of plant, may be placed under the charge of a comparatively inexperienced ex-switchboard attendant as "charge engineer," his salary perhaps being on a level with the wages paid to his engine driver or greaser; and yet there are no regulations in force as yet to prevent this being done.

Thanks to the Board of Trade regulations, our mercantile marine, which we depend upon so much at present, is in a far more enviable and safer position than some of our power stations with regard to its engineers, despite the fact that so many of them have been taken over for naval and transport duties by the Admiralty.

The Institution of Electrical Engineers never has evinced a genuine interest in electrical stations or their engineers; the Board of Trade and the Home Office may, of course, do so in the future, but at present let us hope that if the Ministry of Munitions takes the responsibility of controlling staff matters, it will not overlook the question of competent engineers and an adequate living wage.

Chief Assistant.

Domestic Electric Heating.

Referring to your issue of December 24th, there is one feature of electric heating which appears to have been completely overlooked by most writers. We have found, in Indian hill stations, that a ½-KW. radiator placed *under* a dining or office table provides all the warmth required when snow and ice are all round the house. The air temperature in these circumstances may not be above 45 deg., but this is a matter of no moment so long as warmed air is rising from under the table. As your leader points out, the normal temperature of

60 deg. is no guide whatever to comfort. I am writing from personal experience in three successive winters, with a tariff well below point five, namely 13s. 4d. per KW. of maximum demand with unrestricted use.

J. W. Meares.

London, E.C., *December 30th*, 1915.

The Position of the Swedish General Electric, Ltd.

Questions raised in anonymous letters which have lately appeared in the electrical Press seem to indicate a desire on the part of some writers to ascertain the position of firms having connections with manufacturing companies in neutral countries.

We should, therefore, be glad if you would make it known in your columns, by publishing this letter, that we shall be very pleased to give full particulars of our company and of our parent concern, Allmanna Svenska Elektriska Aktiebolaget, Vesteras, Sweden, on application at our offices, Canada House, Kingsway, W.C., where the documentary evidence we have already had the pleasure of putting before you, and which has also been submitted to the authorities, will be available for inspection.

This evidence, we have no doubt, will be accepted as satisfactory proof that Allmanna Svenska Elektriska Aktiebolaget is a purely Swedish concern, not under the influence of any banks, firms, or persons in countries now at war with Great Britain, and that this company's business has been conducted in a manner in no way detrimental to the interests of the Allies.

None of the shareholders and none of the directors of the Swedish company are of enemy nationality.

The Swedish company has issued in all 150,000 shares, held by 1,530 shareholders. The largest number of shares held in one hand is 2 per cent. of the total.

The Swedish company has no working arrangements or understandings of any kind with enemy firms for the protection or control of each other's interests.

The Swedish General Electric, Ltd., has issued in all 5,000 shares, of which 4,996 are held by Allmanna Svenska Elektriska Aktiebolaget.

The Swedish General Electric, Ltd., has secured the services of various persons resident in England previously in the employ of companies controlled by German capital, but they have done so, following the example of prominent British firms, solely in their own interests, and without any arrangement whatever with the companies by whom such persons were formerly employed, or with the foreign firms controlling same. There is no agreement or understanding whatever with or regarding any such employés by which any such employés shall at any future time enter into their former employment, or into the employ of any other British or foreign firm.

The Swedish General Electric, Ltd., has not since the outbreak of war bought or sold any goods manufactured in countries now at war with Great Britain, or taken over or assisted in the disposal of stock owned at the outbreak of war by companies controlled by enemy capital.

Swedish General Electric, Ltd.
By order of the Board,
W. I. TURNER, *Secretary.*

London, W.C., *January 3rd*, 1916.

WAR ITEMS.

What the Germans Think of Russia's Future Trade.—An American Consular report draws attention to an interesting article on German trade with Russia, which appeared in a recent issue of the "Neue Zürcher Zeitung." Ridiculing any danger of a boycott of all German goods in Russia or of Germany being compelled to yield the Russian market to neutral or the Allied countries, this article lays emphasis on the conservative nature of the Russian merchant, who, it states, is not kindly disposed towards innovations, and could not easily be persuaded to purchase new brands of goods. It points out, as an instance, that the style of electrical apparatus has not changed for 10 years. Allusion is made to the careful "intensive cultivation" of Russian markets by Germany over a long period of years, and the causes of success are stated to be the long credits given by German traders—6, 9, 12 or even 14 months—and the low prices of German goods. It is affirmed that in electrical supplies Germany has no competitor in the Russian market. German influence is extensive; in business houses managers and foremen are almost invariably Germans, and buyers are either German or Russian. "As a result of long years of co-operation there has developed a sense of mutual confidence, and why should it disappear all of a sudden? . . . . A boycott of German goods is altogether out of the question, for the mere reason that the ties resulting from a community of interests extending for a long period of years will bind the two countries again after the conclusion of the war. In conclusion, it may be noted that there is hardly a German commercial house of any size that is not represented in Russia, and that there is a whole staff of German agents and other people who have for years been making their living through German houses, and it is hardly likely that they will suddenly take up with new ventures for the mere purpose of persuading the Russian peasant that French and English goods are better than German. After the war is over the Russian will know no more about France or England than he did before the war, for while he probably never heard English or French he knows something about German, and the Germans saw to it that in every small town there should be some German representative of their business."

Trading with the Enemy.—The Foreign Trade Department of the Foreign Office has been set up by the Foreign Office as a new Department in order to carry out the policy embodied in the Trading with the Enemy (Extension of Powers) Act, 1915. This Act gives power to prohibit trade by any person, firm or company in the United Kingdom with any enemy persons or association established in neutral countries. As the Foreign Trade Department will be concerned with preventing trade by British firms and companies with the enemy in neutral countries, it has been decided to merge with it the Trading with the Enemy Department of the Home Office, which has had the duty of enforcing the measures already taken to prevent trading with the enemy, and the staff of which will continue to perform the same duties as members of the new Department, in addition to taking part in the administration of the new Act. Questions of contraband or the hindrance of oversea trade between neutrals and the enemy and the licensing of exports from this country, and all questions of trading with the enemy other than those described above, will continue to be dealt with by the Government Departments which have hitherto been charged with these questions. In order to secure the full benefit for British interests of the policy of the Department, the advice and assistance of business men will be invited through the Chambers of Commerce and other trade organisations. It is recognised that the success of this policy will depend upon the active co-operation of the business community. It is hoped, therefore, that business men will be willing to aid the Department, and also that they will not hesitate to consult it in any matter in which it can be of assistance to them. Mr. L. Worthington Evans, M.P., has undertaken the direction of the new Department, with the title of Controller of the Foreign Trade Department of the Foreign Office. Offices have been obtained at Lancaster House, The Mall, S.W. (above the London Museum), which were opened on January 5th. All communications (including those relating to matters previously dealt with by the Trading with the Enemy Department of the Home Office) should be addressed to the Controller of the Foreign Trade Department, Lancaster House, The Mall, S.W.

An Australian Desire.—In the Fitzroy Council recently there was a discussion about the purchase of an electric motor. A British firm, which quoted £54, could not supply the motor for which it tendered, and the Works Committee wanted to buy one for £40 from America. It was moved that this be referred back, one councillor saying that they ought not to deal with any but British or Australian firms; another saying that the British firm could not fill the order; and a third suggesting that an Australian gas engine ought to be bought rather than an American electric motor. The matter was eventually referred back, on the understanding that only British or Australian motors be purchased. All of which shows how very strongly the wind is blowing in our favour in Australia at present. May British firms be prepared to grasp the opportunity.

After the War Trade: Government Promises.—The week before last we devoted considerable space to a discussion on after the war problems, which took place in the House of Lords. We welcomed that debate, because we regarded it as an indication that at last the time had arrived for the discussion of such matters in Parliament. While our pages were being run off the machines the House of Commons was holding its last sitting of a momentous year, and Mr. Runciman, the President of the Board of Trade, was giving an account of work which has been undertaken by his department, with the assistance of outside experts, for the purpose of safeguarding our national trade and commercial interests after the war. Many questions have been asked in the Commons on these matters, but the reply has generally been that the Government could not yet make a statement. The fact of Mr. Runciman's speech following so speedily upon the debate in the Lords, seems to us to show that our legislators having got over some of the very serious problems of other kinds, immediately connected with the conduct of hostilities and the production of munitions, that have arisen, are now able to give fuller attention to these other matters which were bound to become of predominant importance sooner or later. We are glad that these speeches were not longer delayed, for in absence of them, profitable discussion, either in the Press or in business circles, could not have continued. We can quite understand that in preparing the way for a Government trade and industrial course of action a large number of subjects have had to be exhaustively investigated, and we do not think any exception can be taken to the adoption of secret inquiry in this connection. Without proper data to go upon no sound, satisfactory, or permanent policy could be evolved which would bear the test of searching public examination when the right time came.

Since Mr. Runciman made his speech the matter has taken on a somewhat altered aspect owing to the controversy in the Cabinet and in the country on the question of compulsion, the single men not having responded as duty called them to do under Lord Derby's scheme. Mr. Runciman, as President of the Board of Trade, has national trade affairs under his care, and if he and Mr. McKenna do not champion the cause of export trade, it is not likely that others will feel that their particular office in the Cabinet requires them to do so. The fact is that all along Cabinet Ministers have emphasised the maintenance of our export trade as far as possible during the war, and others have been agitating for far-reachin- efforts at "capturing" German trade, but when these speeches were delivered apparently those who made them did not know how many men it would be necessary to call away from their ordinary callings in order to ensure victory. Perhaps they do not know now, but we may leave the members of the Cabinet, at this moment, to settle the supreme question, assured that industry will consistently and loyally follow them by making whatever sacrifices are shown to be necessary in order to hurry up the end of the war. But nobody will wish to deprive Mr. Runciman of the credit that is his due for work done at the Board of Trade during the last eighteen months. His speech on December 23rd showed how fully he had entered into the spirit of the trade problems of that period and the other problems that are anticipated. We observe that he has been described in the German Press as our "Minister of Commerce," and while we remember that there has been, and still is, a very wide appeal for the setting up of such an office, we also recognise that a great deal of the work that has been going on in his department is certainly preparatory and investigation work of a kind which can well form a basis for our future national action. Both he and Mr. Asquith have been careful to inform the House that such work has consisted largely of the collection of material, and that some committee or other, either from inside the House or from among Government officials, or from business and other experts outside, will require to analyse and report conclusions indicating what the future policy of the nation consequent upon all these investigations should be. Mr. Runciman showed that practically every item of our commercial life must come under review at such a time as this, for when the war was over not one of them would stand in the same position as before the war. In every case the relationship of Germany and Austria to what might be called the Central Power Zollverein was bound to conflict with our interest. There were some special subjects of a highly technical character which the Board of Trade were not prepared fully to investigate themselves, and these he had referred to a very small team of business men outside. These investigations covered a great variety of subjects. Among them were the use made by the Germans of the English financial system, the use made of British ports by German tonnage, and the position of German owners of British companies who claimed the advantage of our ports and flag, and the ownership of real property by aliens. The Board were sending to Italy an excellent representative to collect information on which they would be prepared to act, with the idea of capturing some of the trade done by Germans previously. As far as commerce was concerned, Germany was a beaten nation, and it was our business to take good care that she did not get her head up to the same extent after the war was over. The advantage of the investigations already made was that they had been made without arousing suspicions. Mr. Runciman said it must be the business of the Board of Trade to see that the commercial men of this country were given every advantage that the Government could place at their disposal, in order to secure for us our share of the commercial and industrial advantages that Germany enjoyed before the war.

Well done, Mr. Runciman! This is the position stated in a nutshell. If the Board of Trade really rises to the occasion in the thorough way that this speech indicates, and if British manufacturers take full advantage of the excellent opportunity that such an aggressive and enterprising policy should put in their way, we shall not have reason to be down-hearted—even the demand for a Ministry of Commerce would not be heard had we a Board of Trade that was really intelligently, and with a full and expert knowledge of our different industries, assisting us in all the ways that are practicable at home and abroad. But why send to Italy only? There are other and vaster countries—and we might say Colonies, too—where the need for "Special Representatives," or for additional ones, is very pressing indeed.

War Effects in New Zealand.—H.M. Trade Commissioner in New Zealand recently reported:—"The pinch of the war is being felt by those engaged in the electrical trade in Wellington. It is not nearly so easy now for an electrical firm to secure delivery of certain lines of goods as it was six months ago. There is a steady depletion of stocks of brass holders and plugs, hitherto supplied by Germany to a large extent, and if a source of supply of these and other small electrical goods is not soon found, some embarrassment will be experienced by the trade during the next twelve months."

Trade After the War.—With a view to focussing the opinion of the commercial community in all parts of the Empire, says the "Daily News," the British Imperial Council of Commerce, which is the representative body of the Chambers of Commerce and Boards of Trade throughout the United Kingdom and British Dominions, is convening a conference in London in June next. A provisional programme has recently been circulated to the members for their consideration. The programme is drafted under three main heads:—Fiscal questions, legislative questions, and voluntary action by Chambers of Commerce and Boards of Trade. The items enumerated under each head include compulsory registration of aliens throughout the Empire, measures against the "dumping" of enemy goods, and the limitation of membership of Chambers of Commerce, etc., to British-born subjects.

It is announced that a joint committee of the London Chamber of Commerce and the National Patriotic Association has called a meeting on the subject of "Business after the War" for Monday, January 31st, at the Guildhall.

Controlled Works.—There are now 2,422 "controlled establishments" under the Ministry of Munitions.

Recruiting Notes.—It is reported to the Eastbourne T.C. that of the regular staff of 39 at the electricity works, 11 have joined the Forces, one has fallen in action, and another has returned medically unfit. Of the present staff, 18 have joined under Lord Derby's scheme, and the other 21 are ineligible.

A report to the York T.C. states that of the staff of 82 in the electricity department, 32 are with the Forces, and 43 in the reserve under Lord Derby's scheme; of the latter, 16 have official badges, and will not be called up. In the tramways department, 40 men are serving in the Forces, and 59 are enrolled in the reserve.

The whole of the eligible members of the staff of the Exeter electricity department have attested under Lord Derby's scheme.

LEGAL.

ELECTROLYTIC ZINC.

As reported in the ELECTRICAL REVIEW of December 17th, the Refractory Zinc Ore Treatment Co. applied in the Patents Court for a licence to use the German Patent No. 605 of 1909 for a process for the manufacture of anodes of massive manganese peroxide for use in the electrolysis of aqueous salt solutions, such as zinc sulphate solutions, to obtain commercially pure zinc.

The massive manganese peroxide anode, however, although it resists chemical action and maintains the electrolyte pure, has a comparatively small electrical conductivity, and the Refractory Zinc Ore Treatment Co. on Thursday, December 30th, applied in the Patents Court for a licence to use Patent No. 15,128 of 1911, belonging to Messrs. Siemens & Halske, of Berlin, for an anode in which pieces or rods of lead peroxide are embedded in pure manganese nitrate or in a mixture of crystalline peroxide and manganese nitrate. By this means is obtained an intimate union of the lead peroxide conductor with the manganese peroxide, so that the conductivity of the anode is increased to the desired degree. The application was heard by the Deputy Controller, Sir Cornelius Dalton.

Mr. Edward Evans appeared for the applicants: Mr. C. Barnard Burdon for the patentees.

MR. BURDON, before the new application was heard, said he desired to correct statements made at the last hearing to the effect that the main work in applying this electrolytic process to the production of pure zinc had been done by the applicants, and that some of Messrs. Siemens & Halske's patents were based on applicants' investigations. He had lately received a belated letter, which indicated that the foreign patentees took out patents about 1913, independent of the experiments of the Refractory Zinc Ore Treatment Co. The royalty offered was a microscopic one.

MR. EVANS said the difficulty was that they did not yet know what was the life commercially of an anode. Applicants were entirely deprived of the patentees' assistance in proving this process experimentally, and applying it economically to zinc. An elaborate and expensive plant would be required to produce the zinc, apart from that required to produce the anodes, and they would have to look to British manufacturers to help them. The patent now being asked for was highly important for the production of zinc. A price on the basis of the zinc produced was an unfair way of reckoning it. He would put it on the weight of the anode. The applicants had developed this thing on its commercial side entirely without the help of Siemens & Halske.

MR. BURDON recommended a double royalty—(1) On the basis of the electrode; and (2) a small royalty on the zinc produced. The small royalty paid to Messrs. Siemens & Halske was due to the fact that the patentees were told that prices were then so cut down in the zinc trade in this country by foreign competition that it would not be possible to pay more.

MR. EVANS suggested a royalty of 5 per cent. on the manufactured anodes. He explained that his difficulty with regard to a royalty on the selling price of zinc was that it would probably be necessary to float a separate company to make the zinc, and for that a great capital would be required. The patent covered both the making of the anodes and the getting of the zinc, and the licence would cover both these processes.

The DEPUTY-CONTROLLER said he gathered that the applicants would pay a royalty of 5 per cent. on the anodes they made for

sale to a zinc-getting company, or 1s. per ton on any zinc they chose to manufacture themselves. The royalty would be on whatever they manufactured for sale.

Mr. Evans: And where we pay royalty on any anodes, there is to be no further royalty in respect of zinc.

Mr. Burdon asked that the licence should specify that the power to use the anodes was not given for any other electrolytic purpose, and that all parties should pay a royalty to be estimated upon the basis of the zinc produced.

Sir Cornelius Dalton said he would communicate with the Board of Trade, and the applicants would hear from them at an early date.

Rose Bros. *v.* Bull.

In the City of London Court, on January 4th, before his Honour Judge Atherley-Jones, K.C., Rose Bros., 38, Beech Street, Barbican, E.C., electricians, sued a man named Bull, trading as W. J. Clarence, 42A, George Street, Richmond, for 10s. 8d. for dry batteries for electric flash lights supplied.

The plaintiff Rose said that the goods were supplied in January of last year. Defendant complained of them, and they told him that they knew they were not as good as they would be in a few weeks, when their batteries would be equal to any on the market. In starting a new factory there were difficulties to contend with. They were making the claim on principle, as defendant had behaved in a truculent fashion, shouting in their place: "You sell nothing but 'dud' batteries." They should have been returned within three months if there were any complaints. In cross-examination the witness said the batteries were made by the British Battery Co. Defendant: They were guaranteed for six months. Plaintiff: If returned unbroken within three months we would have taken them back. Defendant: I gave the order on the understanding that they were English batteries and guaranteed for six months. They were made abroad, probably in Germany. Plaintiff: You complained of the English batteries and we sent you Dutch. We could not get German ones if we wanted. If they were German they would have been good ones. We are now making our own. They are not yet quite as good as the Germans; but they will be as soon as we get the raw material.

Judge Atherley-Jones found for the plaintiff. Defendant: It is not fair. This is an absolute waste of money. The Judge: You should have returned them sooner. I cannot discuss it with you.

BUSINESS NOTES.

Consular Notes.—HOLLAND.—In a report from The Hague, an American Commercial Attaché states that, with the increase of the efficiency of machinery for generating, distributing and applying electricity, and making it less difficult to control, there has arisen an increased demand for small electric motors for work on farms in connection with threshing, feed cutting, churning, &c. The thickly-populated country, with its small and intensive farms, offers an inviting field for enterprise in the form of a central power station. The unlimited water supply from the navigation canals solves the problem of good feed water for boilers and cool condensation water for engines, and counterbalances to a large extent the high cost of fuel. Germany has hitherto furnished most of the electrical machinery, but this source of supply is now practically unavailable.

CHINA.—An unconfirmed report states that the board of directors of the China Eastern Railway has awarded the concession to the Russian firm of Barski & Co., at Harbin, Manchuria, to construct an electric tramway between Pristan and Old Harbin, *viâ* New Harbin, the total length of which is to be about seven miles.

In a comprehensive *résumé* of the effect of the war on South China trade, the American Consul-General at Hong-Kong points out that the chief result of the present state of affairs has been the shutting off of European markets for Chinese products, until prices for such products have fallen so low as to make production unprofitable even where the goods could be sold at all. This has, of course, depreciated the ability of China to buy for import. In most lines, therefore, the year's business has been confined to the liquidation of accumulated stocks. As a result of general business depression, there has been less demand for electrical machinery, and what demand has existed has, consequent upon high prices and uncertainty of delivery of British goods, reached the United States in unusual degree. A contributory cause to the falling off in trade in electrical lines is the cessation of German financing of electrical power and light projects. The Consul-General, whilst claiming an increased and increasing demand for American supplies, frankly admits that this is due more to the unique position of the United States as a great trading non-belligerent nation, than to any special activity on the part of American business men.

SPAIN.—From information supplied by the American Consul at Seville, a German electric company—the Compania Sevillana de Electricidad, of Seville—is having marked success. For the year 1914 the receipts, 2,267,436 pesetas (peseta = 9·6d.), and profits, 980,336 pesetas, show increases over the figures for the previous year of 190,000 and 94,000 pesetas respectively. Since 1911, this company has paid dividends of 8 per cent. annually, established a reserve of 405,000 pesetas, paid 3,348,000 pesetas for the redemption of bonds, and has now a capital of 12,800,000 pesetas. The company manufactures its own electricity in Seville, and has made an arrangement with the hydro-electric company, which takes its power from the Guadiaro, to have the exclusive right to sell its power in this city. It is, however, interesting to note that a new company—the Catalana de Gas y Electricidad S.A.—financed by Spanish and British interests, started business during 1914, and is having considerable success, although this does not appear as yet to have materially affected the receipts of the older Germany company.

SOUTH AMERICA.—The American Consul-General at Buenos Ayres, commenting on a meeting of the board of directors of the Camara Sindical de Comercio with reference to the causes restricting the development of commerce between Argentina and the United States, emphasises the importance of the opportunity which now offers itself to American manufacturers to compete for this valuable market. The causes of American failure in the Argentine have been the refusal to give long credits and neglect to consider the peculiar requirements of the country, resulting in the frequent dispatch of goods of quite a different character from those ordered, on the erroneous principle that the next closest thing will suit as well. Laying stress on the present abnormal conditions and the fact that the deviation of trade to the United States is mainly due to the temporary enforced withdrawal from this market of European countries, the Consul-General urges American traders to utilise the present opportunity to lay a solid foundation so that, at the end of the war, they may have become securely entrenched. Argentine newspapers, notably *La Prensa* and *La Nación*, also openly warn American manufacturers that the present situation must not be taken as a guarantee of the success of American goods when affairs have resumed a normal state. In this connection it is pointed out that the intermediaries and agents in the present accidental commerce are European houses and firms who have recourse to the United States only provisionally, and who logically will endeavour to resume their original relationship as soon as circumstances will allow.

An interesting and instructive table showing the total value of imports of incandescent and other lamps into South American countries from 1910-14 inclusive, is published in a recent American Consular report. The figures for 1913 and 1914 giving details of the imports from each manufacturing country, are not in some cases available, but some interesting comparisons are shown. In Brazil the relative figures from 1910-12 in respect of electric and electric lighting apparatus for Germany, the United Kingdom and the United States, were as follows:—

	Germany. Paper milreis.	United Kingdom. Paper milreis.	United States. Paper milreis.
1910 ...	2,401,121	1,788,954	4,625,363
1911 ...	3,695,937	2,635,266	5,079,112
1912 ...	4,251,435	1,760,080	6,368,801

The figures for the Netherlands and Austria-Hungary for the same period rose from 14,108 to 75 718 paper milreis, and from 20,628 to 109,147 paper milreis respectively. For incandescent lamps imported into Argentina, the figures for the United Kingdom show an increase from 1910 to 1913 from 38,000 to 67,000 pesos, for the Netherlands an increase from 96,000 to 108,000 pesos, for Austria-Hungary an increase from 8,000 to 23,000 pesos, whilst those for Germany and the United States show decreases from 324,000 to 241,000, and from 69,000 to 42,000 pesos respectively. The provisional figures for total imports of incandescent lamps for 1914 show a decrease for the year from 495,000 to 257,000 pesos. The figures for Mexico for 1910-12 are rather startling. The total imports for electric incandescent lamps decreased from 704,912 to 647,476 pesos, but the figures for the United Kingdom show a decrease from 26,417 to 550 pesos! The figures for Germany and Austria-Hungary decreased from 274,796 to 183,230 and 25,198 to 11,335 pesos respectively, but increases from 169 to 2,528 and 360,015 to 441,932 pesos are recorded in respect of the Netherlands and the United States. In Peru, out of a total for 1913 of £8,161 in respect of incandescent lamps, only £282 relates to the United Kingdom, the figures for Germany being £4,671 and for the United States £2,963.

Copper Stealing.—A fine of £20 was imposed by the Widnes Magistrates, on Thursday last week, on Victor Horace Osborne, foreman erecting electrical engineer, of Chatham Street, Stockport, who was charged with stealing 162 lb. of copper and 421 lb. of copper, the property of his employers, the B.T.H. Co. It was stated that the prisoner was supervising the erection of electrical plant at the Sullivan Chemical Works, Widnes, and Supt. Foster said that the police visited a local marine store and found that prisoner had disposed of a quantity of copper. For failing to enter in a book an account of all articles purchased, Charles Bond, marine store dealer, of Lugsdale Road, Widnes, was fined 40s.

Receiving Stolen Copper.—Thomas Wilson, coal and metal merchant, of Pendleton, was sentenced to six months' imprisonment in the second division by the Salford Recorder, on Monday, on a charge of receiving 1 cwt. of scrap copper, well knowing it to have been stolen. The copper was taken from the British Westinghouse works at Trafford Park.

Bankruptcy Proceedings.—William Carey Wild, electrical engineer, 57, Rhodes Street, Halifax.—At Halifax Bankruptcy Court, on December 30th, a receiving order was made on debtor's own petition. First meeting, January 12th; public examination, January 14th, both at Halifax.

Augustine Garbutt, "electrical engineer, now weighing machine attendant," Leeds.—Receiving order made December 31st, on debtor's own petition.

Trade in 1915.—The January issue of the *Chamber of Commerce Journal* contains a series of special reports by experts in the leading trades, regarding the trade and industry of the United Kingdom in 1915.

Trade Announcements.—THE LONDON COMMERCIAL ELECTRICAL STORES, LTD., have removed their offices and stores to 13, Farringdon Avenue, E.C. Telephone number: "Holborn 530"; telegrams: "Galvorite, London."

Owing to the increased business, MESSRS. CAVE & HIGGIN, LTD., have removed to more commodious premises at 265, Deansgate, Manchester (telephone number: "Central 1283").

Catalogues and Calendars.—THE VICTA ELECTRICAL CO., of 60, Queen's Road, Battersea, S.W., have issued a circular relating to their facilities for repairing electric meters during wartime; also a wall calendar for 1916, with monthly tear-off slips.

MR. W. H. JOHNSON, of 14, Panton Street, London, S.W., has in circulation a wall calendar, with small monthly slips for 1916, which in design effectively illustrates the fact that he is sole European representative for "Remy" electric apparatus.

THE DAVENPORT ENGINEERING CO., of Harris Street, Bradford, have prepared a wall calendar, with daily date slips, for the current year.

THE COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., of Moorgate Court, E.C., have prepared a telephone card for the convenience of consumers.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—New catalogue of between 40 and 50 pages giving illustrated particulars of their various types of "Witton" starters, regulators, starting panels and controllers. Prices and other details are tabulated, and dimensioned drawings and diagrams of connections occupy the last few pages.

MESSRS. POPE'S ELECTRIC LAMP CO., LTD., Hythe Road, Willesden, N.W., have issued a wall calendar with plainly printed monthly tear-off slips.

MESSRS. THERMIT, LTD., of 27, Martin's Lane, London, E.C., have again issued one of their pocket memoranda books, the opening pages of which contain a good deal of illustrated information concerning Thermit welding, some useful tables, and calendars for 1916 and 1917.

MESSRS. LANGDON-DAVIES MOTOR CO., of 110, Cannon Street, London, E C, have sent us a handy-shaped pocket notebook, the opening pages of which contain tables of information respecting some of their standard sizes and types of motors (single-phase, polyphase, and D.C.), while an insurance coupon lies in the front pocket.

THE L.P.S. ELECTRICAL CO., of 18, Adam Street, Strand, London, W.C.—Pocket pamphlet of 16 pages containing illustrated particulars of their current-carrying universal test clips.

MESSRS. W. BARNS & SON, Globe Works, Queensland Road, Holloway, London, N.—Illustrated circular showing various descriptions of perforated steel cable plates, metals and wire-work.

MESSRS. ALFRED HERBERT, LTD., of Coventry, have sent us one of their very acceptable wall calendars with monthly sheets for 1916, with bold figuring on good white paper.

MESSRS. PORTER PATENT SAFETY SEALS, LTD., 7 to 9, Belfast Road, London, N.—Prices and samples of their patent safety seals for electricity meters, &c.

Dissolutions and Liquidations. — POWER GAS ECONOMY, LTD.—This company is winding up voluntarily, with Mr. J. Duncan as liquidator. A meeting was called for yesterday at 149, West George Street, Glasgow.

NELSON'S COAL CONVEYOR, LTD.—A meeting of creditors is called for January 3rd, at 142, Park Road, Wallsend. Mr. T. Rose, liquidator.

BILBIE, HOBSON & Co., engineers, 106 Queen Victoria Street, E.C., and Deverell Street, Great Dover Street, S.E.—Mr. H. G. Hall has retired from the partnership, and Messrs. J. Bilbie and J. S. Wylde will continue the business under the same title, &c.

CEDES ELECTRIC TRACTION, LTD.—A petition presented by the Tudor Accumulator Co., Ltd., for the winding up of this company, is to be heard on January 18th, in London.

SALSBURY LAMPS, LTD.—A meeting is to be held on February 7th, at 15, Eastcheap, E.C., to hear an account of the winding up from the liquidator.

Book Notices.—"The *Mechanical World* Electrical Pocket Book for 1916" (Emmott & Co.; price 6d. net) contains new sections on switchgear and switchboards, earthing, "reductors" for half-watt lighting, and the efficiency of dynamos and motors, and the accumulator notes and sections on lighting circuits and switching, and electric lighting, have been revised and extended. The book gives a remarkable amount of condensed information for the small price charged, and has the great advantage that it opens like other books.

"The *Mechanical World* Pocket Diary and Year Book for 1916" (Emmott & Co.; price 6d. net), now in its 29th issue, contains several new tables, while much additional information regarding steam boilers has been inserted. A separate section is devoted to the Diesel engine, and notes on brazing and soldering have been added.

Measurements for the Household (Circular No. 55 of the Bureau of Standards, U.S.A.) is a remarkable departure from precedent, in that although the product of a Government Department, it takes cognisance of the existence, requirements and implements of the domestic household and aims to instruct the householder as to units and methods of measurement generally, methods of checking the quantities of goods bought by weight and measure, and the methods in vogue for cheating him—or rather, her. In this country, we fear, the average housekeeper would actively resent such an incursion into her sphere, which she believes she alone understands, and she would certainly decline to be taught anything about the efficient management of her domain; but perhaps our trans-Atlantic cousins are less dogmatic in such matters and are willing to learn something of scientific method. We have examined the circular—which comprises nearly 150 pages—with interest, and unreservedly congratulate the authors on the manner in which they have carried out their work, and on the admirable matter, both text and illustrations, which the volume contains. True and false weighing and measuring instruments (some of the fraudulent ones showing marvellous though misguided ingenuity), thermometry, fuels, combustion, lighting, electricity, gas and water supplies, with the corresponding meters, humidity, barometric pressure, hydrometry, and time are amongst the subjects dealt with; the treatment is extremely clear and simple, yet accurate, and the information given undoubtedly should go far to reduce the waste and increase the comfort obtaining in the domestic household. Although the first edition is only a few months old, a second is already in preparation, and the newcomer merits the warmest welcome and approval.

"Science Abstracts," Sections A and B. Vol. XVIII, Part 12, December 28th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each.

The December number of the "*Journal* of the Tramways and Light Railways Association" contains a full list of members of the Association and their addresses.

"*Journal* of the Institution of Electrical Engineers." Vol. 54. No. 253. January 1st, 1916. London: E. and F. N. Spon, Ltd. Price 3s. 6d.—This issue contains the following papers:—"Design of High-Pressure Distribution Systems," by Mr. J. R. Beard; "Mathematical Design of Transformers," by Prof. D. Robertson; "Electric Generating Stations in China," by Prof. C. A. Middleton Smith; "Pole-Face Losses," by Mr. F. W. Carter.

"The Principles of Dynamo-Electric Machinery." By B. F. Bailey. London: Hill Publishing Co. Price 12s. 6d. net.

"The Electrical Engineers' Diary for 1916." London: S. Davis and Co. Price (stiff boards or limp cloth) 3s. 6d. net.

We have received a copy of a new monthly paper, *Russia*, which is published in London at 6d. It is a commercial, financial and literary review, and contains the official bulletin of the Russian Chamber of Commerce in London. One of the articles discusses engineering prospects in Russia; others deal with Russian traffic routes and Russian credit.

LIGHTING AND POWER NOTES.

Aberdeen.—The Electricity Committee has renewed the contracts for the supply of electricity to the Harbour Commissioners and the Great North of Scotland Railway Co. The number of units generated in November was 1,301,800, as compared with 1,138,140 units in the previous year, an increase of 163,660 units.—*Evening Gazette.*

Birmingham.—PLANT EXTENSIONS. — The Electric Supply Committee recommends the City Council to approve a scheme for extending the temporary generating station just completed at Nechells. This recommendation is the outcome of certain negotiations, and the decision of the Committee, in view of the fact that the temporary station would only be sufficient to meet the demand of existing consumers, not to accept any further applications for supplies. Manufacturers who had accepted orders for urgent work thereupon took steps to compel the undertaking to supply. The alternatives of proceeding with the permanent station, or erecting an extension to the existing temporary station, were considered, but it was found that new plant could not be installed in the permanent station before the winter of 1917, whereas the temporary extension will, it is hoped, be ready for use during the winter of 1916. The cost of the buildings and plant is shown in the following table:—Foundations, engine and boiler house, J. J. Shardlow, £3,500; structural steel work, E. C. & J. Keay, Ltd., £5,890; corrugated asbestos sheeting for roof and walls, glazing, &c., £2,200; 6,000-KW. turbo-alternator, with condensing plant, £27,000; three boilers with superheaters, chain-grate stokers, chimneys, induced draught fans, &c., Babcock and Wilcox, Ltd., £17,000; coal-handling plant, overhead telpherage system, Herbert Morris, Ltd, £3,500; ash-handling plant, £50; overhead crane for engine house, £600; steam, feed and water pipe work, including valves, £5,300; cooling towers, including foundations, Davenport Engineering Co., £5,550; fire appliances, £60; lagging for steam and feed pipes, £160; hotwell feed water tank and connections, £500; engine-room platforms, £200; railway siding, £3,000; high-tension switchgear and cable connections, £5,000; wharf extension, £3,000; contingencies, 10 per cent., £8,240. Total, £90,660. The cost of the underground trunk and distributing mains that will be necessary is estimated at approximately £50,000. If it should be necessary to install economisers there will be an additional expense for economisers and foundations of £8,000. The items of plant against which makers' names are given are those for which tenders have been obtained and submitted to the controlling authority.

Carlisle.—Owing to the heavy rains, the Corporation electric light station was flooded on Friday last, causing a temporary cessation of the electric lighting.—*Times.*

Canada.—The Hydro-Electric Power Commission of Ontario has extended the power plant at South Falls, Muskoka River, by the addition of a 750-K.V.A. unit; the extension will supply the towns of Gravenhurst, Bracebridge and Huntsville.—*Canadian Engineer.*

According to an American Consular report, the plant capacity of the Calgary municipal electrical undertaking is 15,000 KW., the plant consisting of turbine and reciprocating sets with gas fired boilers. At the present time, however, the Calgary Power Co., is supplying the city under a bulk contract, from its hydro-electric plants on the Bow River, 58 miles away, and using the city's power plant as a stand-by unit. The city distribution is at 2,300 volts, three-phase, by means of 233 miles of pole line; the consumers' secondary feeders are single-phase, three-wire, at 110 and 220 volts and three-phase, 220 volts, for power. Some 14,000 meters are in service and 200 miles of streets are electrically lighted. The department is in a prosperous financial position.

Chelmsford.—E.L. PURCHASE.—The T.C. has decided to apply for an order under the Special Acts (Extension of Time) Act, 1915, extending for one year the time within which the Corporation may exercise its option to purchase the local electric light undertaking. In 1894 the B. of T. granted Messrs. Crompton and Co. a provisional order, and the present undertakers are the Electric Supply Corporation, Ltd.

Dublin.—When the chairman of the Lighting Committee recently moved the adoption of a report recommending the Committee's amalgamation with the Electricity Supply Committee, an amendment was moved by Mr. P. T. Daly for deferring the report pending the report of a Special Committee investigating the affairs of the electricity undertaking, and this was agreed to. By 37 votes to 14, the Corporation adopted a report of the Electricity Committee on the charges for electrical energy supplied to theatres.

Erith.—The U.D.C. on December 29th decided to grant a supply of current to the West Kent Electric Co. for a further 200 houses in Colyer's Lane. The electrical engineer has been authorised to install, at a cost of £60, a new centrifugal pump.

Finchley.—E.L. FAILURE.—The electrical engineer, reporting upon the recent breakdown of the mains, said that this was the first occasion on which the supply of current had been completely disorganised since 1903. Each of the three main areas of supply was affected, and there were numerous minor faults on consumers' premises. The breakdown had partially damaged the large generating set. The major fault was due to a pick hole in one of the distributing mains, and the engineer is of opinion that all street openings should be under supervision, as similar damage had been done on several occasions. The engineer spoke highly of the manner in which the staff and men worked to clear the breakdown. The suggestion with regard to the supervision of future excavations was adopted by the Council.

Halifax.—PROPOSED LOAN.—The Corporation proposes to apply to the L.G.B. for power to borrow £5,558, the additional cost in connection with the purchase of plant required at the electricity works.

The General Purposes Committee has referred to the Electricity Committee a request for an advance of wages by the employés of the electricity department.

Hereford.—LOAN REFUSED.—The L.G.B. has refused the application of the T.C. for sanction to a loan for additional plant at the electricity works on the ground that the matter is not one of pressing necessity. The Council, in consequence, will not entertain for the time being any applications for new supplies, nor any extension of any existing supply.

Heston and Isleworth.—ELECTRICITY PRICES.—The Electricity Committee has again decided to retain the present price of current, as in view of the probable falling off in the quality of gas, owing to the extraction of constituents for manufacturing purposes, the undertaking would be likely to reap the benefit of an increased demand.

Leamington.—A sum of £300 is to be spent on X-ray apparatus and an electrical installation at the Warneford and South Warwickshire Hospital.

Leicester.—PLANT EXTENSIONS.—Having received numerous applications for increased power supply from manufacturers, the Electricity Committee recommends the Council to sanction an expenditure of £14,000 for the immediate provision of cables and for anticipated requirements, for which official approval will be given.

Lincoln.—PRICE INCREASE.—The T.C. has decided to increase the accounts of all ordinary consumers for lighting and power by 20 per cent. from the completion of the meter readings for the Christmas quarter's accounts.

London.—BETHNAL GREEN.—The Electricity Committee of the B.C. has had under consideration the question of the method to be adopted in dealing with the mains and services laid by the Shoreditch B.C. in the Bethnal Green area. The Shoreditch Council has from time to time during the past 12 years laid mains and services, some of the work being undertaken on the understanding that the Bethnal Green authority would, when in a position to supply current, purchase the mains of the Shoreditch Council, whilst other works have been carried out by the latter authority in the absence of objection on the part of the Bethnal Green authority. The Committee recommends the Council to authorise it to negotiate further with the Shoreditch Council for the purchase of the mains and apparatus in order that the matter can be settled promptly.

Manchester.—LOAN SANCTION.—Sanction has been received for the borrowing of £8,250, repayable within 60 years, for the purchase of certain lands required in connection with the scheme for the establishment of an electricity generating station at Barton.

Paisley.—YEAR'S WORKING.—For the year ended May 15st last, the Corporation electricity undertaking earned a gross revenue of £25,908 and a gross profit of £11,072, and after meeting the usual financial charges and taxes, a surplus remained of £446, as compared with £395 in the previous year. The units sold during the year amounted to 4,036,611, which included 1,703,128 units supplied to the Paisley District Tramways Co., and 1,428,000 units supplied for power purposes. The output sold compares with 3,839,857 units for 1914.

Salford.—PROPOSED LOAN.—The Electricity Committee has decided to recommend the Council to apply to the L.G.B., for sanction to borrow £1,600 for a 500-KW. rotary converter set, together with the requisite switchgear and low-tension cable.

Southend.—L.G.B. SANCTION.—The L.G.B. has sanctioned the loan for the provision of engines at the Leigh and Thorpe Bay sub-stations, on the understanding that the Corporation will endeavour to dispose of the machinery and will not fix the same without the Board's consent. A further communication is to be made to the Board on this matter.

Stalybridge.—LOAN APPLICATION.—The Joint Board has decided to apply for sanction to the borrowing of a sum not exceeding £20,000 for an extension scheme at the generating station to meet the increasing demands for energy. It is proposed to install another turbine set.

West Bromwich.—LOAN SANCTION.—The Electricity Committee of the T.C. has obtained sanction to borrow £8,850 for the extension of generating plant as follows:—£1,759 for economiser, steel chimney, motor for stoker and water softener; £4,517 for boiler machinery, &c.; and £2,574 for engine house extension and for foundations for boilers, chimneys, &c. The Committee recommends the entering into of an agreement with the Oriental Tube Co. for the supply of current of a minimum quantity of 80,000 units per annum.

Wharfedale.—E.L. SCHEME.—In regard to the scheme of various Wharfedale District Councils, with a view to the establishment of a joint electricity supply undertaking, it appears that the Otley and Burley Councils have suddenly withdrawn without attending a meeting of the joint committee to intimate their intention. In a report from the Wharfedale Electricity Sub-Committee, presented to the Guiseley Council, it was suggested that providing there was a unanimous desire on the part of the Councils concerned to allow a private company to come into the district it would be advantageous if each Council had a similar agreement with such company. Dr. Muschamp, the originator of the joint scheme, said a tentative scheme had been drawn up, with a recommendation that each Council should take a census with the object of ascertaining what demand there would be for electricity. The scheme must remain in abeyance at present because the Board of Trade had clearly intimated that it would not grant any order to any company during the period of the war.

Whitstable.—At a special meeting of the U.D.C. on December 28th, it was reported that the debenture-holders of the local Electric Supply Co. had appointed a receiver. A resolution was passed to the effect that the Council should only continue generating current in the usual manner until January 7th, unless on or before that date the debenture-holders stated their willingness to recoup the Council for all expenses incurred.

York.—DEFERRED EXTENSIONS.—The Electricity Committee has recommended the T.C. to apply for an extension of time for the laying of mains in the Bishopthorpe and Acomb districts under the 1914 order.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—TRACK MAINTENANCE.—Some discussion is likely to arise in the T.C. regarding a proposal emanating from the Tramways Committee that the maintenance of the tramway track should be handed over to that department.

Belfast.—FEMALE LABOUR.—At the meeting of the Corporation, on Monday last, Alderman Tyrell, of the Electrical Committee, in reply to a Labour protest against the employment of women as conductors on the trams, said that, if it was necessary to employ women, it would be done. Some discussion followed on the age of conductors, which had been reduced from 19 to 17 years, and also on a recent electrical explosion in one of the streets.

Blackpool.—CONTRACT TICKETS.—The T.C. on Tuesday last had another long debate on the question of tramway contract prices. The tramways manager recently reported that the existing charge of £3 per annum for the entire system was resulting in a loss of about £2,000 a year to the department, but the General Purposes Committee last week supported a recommendation that any change should be deferred until after the war.

Ald. Grime submitted that the Council should settle the matter at once by raising the price to £5. The amendment was defeated, so that the existing charges will remain in force.

Bradford.—FEMALE LABOUR.—Over 300 applications have been received for the 20 posts of women car conductors which have been decided upon by the Tramways Committee as an experiment.

During the storm of Saturday last a double-decked tramcar was blown over in Idle Road, the two passengers receiving slight injuries.

Canada.—Thirty Ontario municipalities have endorsed the proposal to construct an electric railway from Toronto to London (Ontario), at a cost of £2,800,000.—*Morning Post.*

Colne.—The T.C. has refused to accede to a request by the Tramway Workers' Union that the advance of 5 per cent. which the Council made at its last meeting, should be regarded as permanent, and not as a war bonus.

Erith.—The U.D.C. has decided to apply for a prov. order to alter or amend the Tramways Improvement Act, so as to enable the Council to run motor-'buses in certain districts.

Glasgow.—TRAMWAY ACCIDENT.—On Saturday last an accident occurred to one of the Corporation electric cars, which left the rails at a sharp curve, and crashed into the wall of the Forth and Clyde Canal. The force of the collision caused the upper portion of the car to become separated from the lower, and to hang sideways against the wall. Over 40 passengers were on the car, and several were badly injured, including the woman conductor, the most serious cases being removed to the Western Infirmary.

Leeds.—NEW TRAMWAY OFFICES.—The Corporation tramway department moved during several days last week from its old premises in City Square to a new building at the corner of Lower Briggate and Swinegate. The new headquarters are to be shared by the Highways department, and the estimated cost of the place is £30,000. A new headquarters has long been urgently needed, the growth of the tramway system having been very rapid in the last 15 years.

Preston.—The Tramway Committee, after considering a statement of receipts, has declined to discontinue the Sunday morning car service. Girls are to be employed for the tramway parcel delivery service.

Manchester.—The B. of T. has extended for one year the time limited by the Manchester Corporation Act, 1911, for the construction of certain authorised tramways within and beyond the city.

Radcliffe.—ACCIDENT.—Nine persons were slightly injured on Monday in a tramway accident. Harry Pusey, the driver of the car, was driving down Radcliffe New Road, at about eight miles per hour, and when he tried to apply the brakes, about 200 yards from the bottom of the decline, the wheels began to skid. He applied other brakes, but the car gained speed, collided with a lorry, and ran off the track into a shop-front.

U.S.A.—CHICAGO ELECTRIFICATION REPORT.—The long-waited report of the "Chicago Association of Commerce Committee of Investigation on Smoke Abatement and Electrification of Railway Terminals" has at last been made public. It contains some 1,200 pages, and apparently comes to the conclusion that railway electrification would have a negligible effect in reducing smoke polution, and that if carried out, the railways would have to meet an estimated annual loss of over 14 million dollars on the undertaking. The electrification of every mile of track in the city would involve 3,476 miles, 1,476 miles being main line, and affect 38 railroads.

The Committee in estimating the cost of electrification considered several systems, and found comparatively little difference in cost. The least costly scheme was an 11,000-volt single-phase trolley system ($178,000,000); a 2,400-volt direct-current trolley system was estimated to cost $191,000,000; and a 600-volt D.C. third-rail system $198,000,000, but this system was regarded as impracticable on account of the number of gaps in the third rail, while the overhead trolley system would be hampered by the number of structures across the track. The estimated annual deficit arises from the burden of annual charges to be met, electric working being in itself cheaper than steam operation. Steam locomotives were found to be responsible for only 10 per cent. of the gaseous polution of the air, and it was considered that electrification would reduce the visible smoke in the city by only 20 per cent. As pointed out by an American contemporary, the extent of this smoke nuisance to the city at large may be of minor importance, but its concentrated nature in certain localities may have an important bearing on the matter.

One result of the publication of the report has been a unanimous decision of the Chicago City Council instructing the Council's Committee on railway terminals to consider immediately the electrification of the steam railways within the city, and report as to the necessary ordinances to bring this about—the Council thus ignoring the findings of the Chicago Association of Commerce.

The engineers to the Boston Elevated Railway Co. have recommended the addition of a 35,000-KW. turbine set to the South Boston station, which contains three 15,000-KW. turbo-generators. The engineers point out that while a 20,000-KW. set would provide sufficient power to meet reasonable demands temporarily, the larger unit would cost considerably less per KW. and be more efficient. It is estimated that the additional cost ($200,000) would be repaid within five years by these savings. With an estimated five years' output of 1,180,000,000 units, the manufacturing costs are estimated at $3,200,000 with the larger set, and at $200,000 more for the smaller set; the use of the larger machine with its less steam consumption would also defer the necessity for additional boilers for one year beyond the time if a 20,000-KW. set were installed. The engineers also mention the tendency towards higher boiler pressures, it being considered practicable to build equipment for 400 lb. per sq. in. or more. The Boston Co. is rearranging its sub-station plant and substituting 4,000-KW. rotary converters for smaller units.

TELEGRAPH and TELEPHONE NOTES.

Ceylon.—According to *Indian Engineering*, the wireless equipment of Ceylon has been so much improved that the Island can now receive messages from Paris and Cornwall.

Postal Telegraphists.—It has been arranged with the War Office that no Post Office servant who has been attested shall be called up until the Postmaster-General has intimated that arrangements can be made for his release. Telegraphists and skilled workmen included in the revised waiting list for the Royal Engineers will not be called up with the groups into which they fall, but will be retained in their civil positions until they are required for enlistment in the Signal Service.

Russia.—"Urgent" telegrams to Russia at the rate of 1s. 1½d. per word were instituted on January 1st. These telegrams have priority over other private messages.

Switzerland.—According to official reports, the Swiss telegraph and telephone network had, at the end of 1913, an extent of 10,389 km. The telegraphic traffic during 1913 increased to 6,140,526 telegrams (an increase of 182,512 messages). Telephone subscribers totalled 80,517, the wire serving them being 336,419 km. in extent. The interurban circuits and international circuits had a total length of wire of 65,099·8 km. The number of conversations was 73,733,935. The aggregate of receipts totalled 21,182,715 fr.; expenses were 20,016,955 fr. The profit was, consequently, 1,165,760 fr.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—January 19th. P.M.G. Carbon and manganese powder, manganese chloride, chloride of ammonia, porous pots, outer jars and carbon blocks. See "Official Notices" to-day.

February 18th. Melbourne, Brunswick and Coburg Tramways Trust. Six radial trucks.*

BRISBANE.—January 23rd. P.M.G. Wheatstone apparatus. See "Official Notices" Dec. 17th.

April 15th. P.M.G. Common-battery multiple switchboard, or automatic or semi-automatic switchboard, and associated apparatus. See "Official Notices" December 31st.

MELBOURNE.—February 16th: 51 electric staff instruments. February 23rd: Two commutator slotting machines, for the Victorian Railway Commissioners.*

SYDNEY.—January 31st. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

January 20th. Silk-covered wire, for P.M.G.*

February 7th. Metropolitan Board of Water Supply and Sewerage. For No. 1 pumping station at Ultimo. Two centrifugal pumps and electric motors (4,000 gallons per minute each), switchboards, starters, &c. Contract No. 1,301.*

February 28th. Municipal Council. Tenders for induction regulators. Specifications (11s. 6d.) from the Electric Light Department, Town Hall, Sydney.

May 3rd. N.S.W. Railways and Tramways Department. One 2,500-KW. turbo-alternator, for Zara Street, Newcastle, power house. Specifications (20s.) from the Engineer's office, 61, Hunter Street, Sydney.

Darlington.—January 12th. Corporation. Coal bunkers, elevators, &c., for the electricity works. Specifications from the Borough Electrical Engineer, Haughton Road.

Dublin.—January 12th. Port and Docks Board. Twelve months' supply of electrical supplies. Forms from Mr. N. Proud, Secretary, Port and Docks Office, Westmoreland Street.

Leeds.—January 15th. Electricity Department. Steam coal (small slack, smudge or similar material) during the period ending July 31st or December 31st, 1916. Mr. C. N. Hefford, City Electrical Engineer, 1, Whitehall Road.

London.—ISLINGTON.—January 21st. B.C. Twelve months' supply of engine-room stores, electrical fittings, meters, cables, &c. See "Official Notices" Dec. 31st.

New Zealand.—AUCKLAND.—February 23rd. City Council. Centrifugal pumping electric motors, and automatic starting and controlling apparatus, for the four city pumping stations. Specifications from the office of the Water Board, Town Hall, Auckland.

DUNEDIN.—May 17th. City Council. (1) Tramcar bodies; (2) electrical equipment. Plans, &c., from the Town Clerk, Dunedin.

RAETIHI.—March 14th. Town Board. 40-H.P. hydro-electric generating set, switchboard, &c. Plans and particulars from Messrs. H. W. Climie & Son, Raetihi.*

South Africa.—January 17th. S.A. Railways Administration, Johannesburg. 74,966 drawn-wire tungsten lamps.*

Spain.—Tenders have just been invited by the municipal authorities of Puerto de Bejar (Province of Salamanca) for the concession for the electric lighting of the town during a period of 20 years.

The municipal authorities of Bodon (Province of Salamanca) have lately invited tenders for the concession for the electric lighting of the town during a period of three years.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aberdeen.—The Corporation Tramways Committee has accepted tenders for ironwork and supplies of wood from Messrs. Cruickshank & McIntyre, Ltd., and Messrs. John Fleming & Co.

Australia.—The Brisbane Hospital Committee has accepted the tender of the Brisbane Electrical Co., at £3,852, for the installation of electric light and power.

The Sydney Harbour Trust has accepted the tender of Messrs. Gibson, Beattie & Co. for six electric wharf capstans, for Pyrmont. —*Tenders.*

Bristol.—The Corporation Electrical Committee has accepted the tender of the East Bristol Collieries, Ltd., for a six months' supply of coal to the Avonbank works. The estimated amount is £11,540.

Grimsby.—The Electricity Sub-committee recommends the purchase of the following coals from Messrs. Ed. Bannister and Co., Ltd.:—

250 tons of Brodsworth nutty slack, at 15s. 6d. per ton, to be delivered during January.
5,000 tons of Sherwood slack, at 12s. 4d. per ton, to be delivered during the next 12 months.

Keighley.—The Tramways Committee has recommended the acceptance of the tender of Messrs Clough, Smith & Co., Ltd., to construct the overhead equipment for railless trolley vehicles from the present terminus at Hebden Road, Haworth, to Lower Town, Oxenhope, the capital payment to be suspended until after the war.

Leicester.—The Electricity Committee recommends the Council to seal the following contracts:—

Siemens Bros. Dynamo Works, Ltd.—An additional 1,000-KW. rotary converter and switchgear cables, &c., at £2,450.
British Electric Transformer Co., Ltd.—One set of 100-KW. transformers, one spare transformer, one 75-KW. single-phase transformer, and one 50-KW. single-phase transformer, at £312.
G. Fletcher & Co., Ltd.—Additional coal-handling plant, at £1,952.

London.—L.C.C.—The following tenders have been accepted by the L C C. for the supply of electric lamps:—

Corona Lamp Works, Ltd.—Items 8-13, 18-21, and 26 (metallic-filament lamps, with filaments of drawn wire).
Crysteo, Ltd.—Items 2-27 (metallic-filament lamps, with filaments not of drawn wire).
Edison & Swan U.E.L. Co., Ltd.—Items 1-7 (carbon-filament lamps).

Manchester.—The Electricity Committee has accepted the following tenders:—

One set of induced-draught plant.—Musgrave & Co., Ltd.
One steam-turbine-driven boiler feed pump.—Worthington Pump Co., Ltd.
Two electrically-driven circulating water pumps.—Mather & Platt, Ltd.
Coal-conveying plant.—Babcock & Wilcox, Ltd.
Water cooler.—Klein Engineering Co., Ltd.
Railway track and crossing.—Marple & Gillott, Ltd.
Steelwork required in boiler house No. 2.—Francis Morton & Co., Ltd.
Fountains for new cooling towers and boiler house No. 3.—F. Mitchell and Co., Ltd.
Periodical inspection and insurance of two boilers and economisers.—National Boiler & General Insurance Co., Ltd.
Length of ozone-proof cable.—Pirelli-General Cable Works, Ltd.

Salford.—The Electrical Committee has accepted the following tenders:—

500-KW. rotary converter set.—British Westinghouse Co., £1,450.
4-ton Albion motor petrol wagon.—Albion Motor Car Co., Ltd., £775.

The Tramways Committee has accepted the tender of Messrs. Hadfields, Ltd., for 14 manganese-steel crossings, at £292; and the offer of Messrs. Brown, Bayley's Steel Works, Ltd., for 300 steel tramcar tires, at £4 10s. 9d. per tire.

West Bromwich.—The following tenders for the supply of plant have been recommended by the Electricity Committee for acceptance:—

Gwynnes, Ltd.—Motor-driven centrifugal pump.
Kennicott Water Softener Co.—Water softener.
Cochrane & Co., Ltd.—C.I. pipes.
Babcock & Wilcox, Ltd.—High-pressure steam pipes.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, January 7th. At 7.45 p.m. At the Temperance Institute, 19, West Stewart Street. Paper on "The Economy of Electricity in a Small Household," by Mr. W. B. Smith.

Electro-Harmonic Society.—Friday, January 7th. At 8 p.m. At Holborn Restaurant. Smoking concert.

Manchester Association of Engineers.—Saturday, January 8th. At Grand Hotel, Aytoun Street. Paper on "The Importance of Uniform Conditions for Engineering Operations and Industrial Work," by Mr. A. Etchells.

Institution of Civil Engineers.—Tuesday, January 11th. At 5.30 p.m. At Great George Street, Westminster. Paper on "The Electric Locomotive," by Mr. F. W. Carter.

Illuminating Engineering Society.—Tuesday, January 11th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi. Discussion on "Some Principles in Industrial Lighting (with special reference to the first Report of the Departmental Committee on Lighting in Factories and Workshops)" to be opened by Mr. J. S. Dow.

Institute of Marine Engineers.—Tuesday, January 11th. At 7 p.m. At Tower Hill, E.C. Paper on "Power-driven Tools on board Ship," by Mr. J. Hamilton Thomson.

Liverpool Engineering Society.—Wednesday, January 12th. At the Royal Institution, Colquitt Street. Paper on "Marine Refrigeration," by Mr. J. Wemyss Anderson.

Association of Engineers-in-Charge.—Wednesday, January 12th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Limit Gauges and their Application," by Mr. W. H. Booth.

Institution of Electrical Engineers.—Thursday, January 13th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Predetermination of the Performance of Dynamo-electric Machinery," by Prof. Miles Walker.

(**Newcastle Local Section**).—Monday, January 10th. At 7.30 p.m. At the Mining Institute. Paper on "The Design of High-pressure Distribution Systems," by Mr. J. R. Beard.

(**Scottish Local Section**).—Tuesday, January 11th. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "Distribution and Rise of Temperature in Field Coils" (part II), by Prof. M. Maclean and Mr. D. J. Mackellar.

(**Manchester Local Section**).—Tuesday, January 11th. At 7.30 p.m. At the Engineers' Club, 17, Albert Square. Paper on "The Predetermination of the Performance of Dynamo-electric Machinery," by Prof. Miles Walker.

(**Birmingham Local Section**).—Wednesday, January 12th. At 7 p.m. At the University, Edmund Street. Paper on "The Predetermination of the Performance of Dynamo-electric Machinery," by Prof. Miles Walker.

(**Yorkshire Local Section**).—Wednesday, January 12th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "The Design of High-pressure Distribution Systems," by Mr. J. R. Beard.

Chemical Society.—Thursday, January 13th. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

NOTES.

Bristol Corporation and Enemy Goods.—At a meeting of Bristol City Council on Saturday a resolution was passed requesting the Corporation Committees to avoid as far as possible trading with firms containing Germans or German capital. It was suggested that Sir W. H. Davies, M.P., who was present, should draw the attention of Parliament to such trading by Government departments.—*Times.*

The City Council had a lengthy discussion on the matter a few days ago, the question being raised with reference to a contract for main cable for the Royal Edward Dock, placed with Messrs. Siemens Bros., Ltd. Alderman Pearson, who was the principal speaker, said that whether the works were under Government control or not it did not affect where the profit went. If the profit went into the hands of the public trustee he was of opinion that it would largely go to Germans when the war was over, and at the end of the war it would be used to bargain with Germany, and Germany would get it directly, or as a set-off. Alderman Pearson went on to give illustrations of the way in which relatives and friends of his own, Englishmen, who had been in control of businesses in Germany up to the outbreak of war, were being treated in Germany—living either in gaol or in horse boxes. He proposed:—"That all Committees of the Council be instructed, when placing orders, to avoid any business which is enemy-owned or is managed or worked directly or indirectly by or under the influence of enemy subjects, or is carried on wholly or mainly for the benefit of or on behalf of enemy subjects, notwithstanding that the firm or company may be registered or incorporated within the King's Dominions." After discussion, in the course of which it was shown that the firm had supplied machines, and unless they were to be allowed to replace parts in case of breakdown it might be very awkward, also that they were patronised by the Government, and had supplied war materials to the Government, Alderman Pearson wished to add the words "as far as possible." He said that it was his idea that they should go to Messrs. Siemens when it was absolutely necessary. The resolution as amended was agreed to. A report of the discussion will be found in the *Bristol Times and Mirror* for January 3rd.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The Council has decided that during the war any candidate for admission as Associate Member who is engaged on naval or military service, or employed (whole time) in an engineering capacity on munitions or other war work, shall be exempted from complying with the examination regulations, and any such service may be accepted in part fulfilment of the conditions laid down with regard to experience, provided that in other respects the candidate satisfies the requirements as to age and training.

The Council has asked the National Service Committee of the Institution to formulate a scheme for giving to disabled sailors and soldiers a preliminary training as switchboard attendants, &c., and for obtaining means to carry on this work and arranging for the selection and distribution of applicants for positions.

The following local hon. secretaries and treasurers have been appointed:—Mr. H. Hastings, for Spain; Mr. A. C. Kelly, for Argentina; Mr. W. M. L'Estrange, for Queensland.

The following arrangements are announced for meetings to be held in London between now and May:—

January 13th.—Prof. Miles Walker, "The Predetermination of the Performance of Dynamo-electric Machinery."
January 20th.—H. H. Harrison, "The Principles of Modern Printing Telegraphy."
February 10th.—O. L. Record, "The Testing of Underground Cables with Continuous Current."
February 17th.—C. Chree, D.Sc., F.R.S., "Terrestrial Magnetism." (The seventh Kelvin Lecture.)
March 9th.—E. V. Pannell, "Continuous-current Railway Motors."
March 16th.—N. W. Storer, "The Possibilities in the Design of Continuous-Current Traction Motors."
April 13th.—(To be announced later.)
May 11th.—Annual General Meeting.

Fatalities.—At Manchester on Tuesday an inquest was held on Henry Wharton, aged 17 years, who had been employed at a Manchester munition works. Deceased was being instructed in the work of driving an overhead crane. On December 31st he appeared to have left the cabin of the crane (although he had no need to do so), and he was seen with his hand on a "live" wire well above the cabin. He fell to the ground and died later. "Accidental Death" was the verdict.

At the adjourned inquest at Eastbourne in connection with the death from electric shock of two men who attempted to render assistance to a motor-car which collided with and smashed a 2,500-volt switch pillar on December 26th last, the jury returned a verdict of "Death from Misadventure," adding a suggestion that such boxes should be further from the side of the road. Mr. A. P. Trotter, electrical adviser to the Board of Trade, represented the Board at the inquiry.

On Tuesday last, Arthur Walker, an electrician at Skinningrove Ironworks, slipped into some gearing, receiving injuries which necessitated the amputation of a leg.

For Sale.—Messrs. Percy Huddleston & Co. will sell by auction without reserve, at 158, Falcon Road, Clapham Junction, S.W., on January 13th, a 230-volt motor, motor fans, arc lamps, cables, wires, &c., of which some particulars are given in our advertisement pages to-day.

Appointments Vacant.—Shift engineer (£130), for the City of Birmingham Electric Supply Department; electrician (50s.), for the Abertillery U.D.C.; assistant electrical engineer (£130), for the Government of Malta Electric Lighting Department. See our advertisement pages to-day.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER ENGINEER CORPS.—Orders for week commencing January 10th, 1916.—By Lieut.-Col. C. B. Clay, V.D., Commandant.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, January 10th.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, January 11th.—School of Arms, 6 to 7 p.m.

Thursday, January 13th.—Shooting for Sections 1 and 2, and Signalling Section.

Friday, January 14th.—Sections 3 and 4, Technical; Sections 1 and 2, Squad, Signalling Section and Recruits.

Saturday, January 15th.—Uniform Parade. Time and place will be posted at Headquarters later.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Captain R. J. C. Eastwood (Sub-Commandant), Thursday, January 6th, 1916:—

Captain of the Week.—Mr. C. F. Holland.

Orderly Officer.—Mr. F. Owen.

Week-end Parades.—Saturday.—A, B and D Companies will parade at Baker Street Station at 2.30 p.m. and proceed by train to Willesden, where they will detrain, and proceed by march route to Wembley Park. C Company will parade at the same time at Baker Street Station, and proceed direct to Wembley Park by train.

Sunday.—Field Day.

The Battalion will parade at King's Cross (G.N.R.), at 9.30 a.m. sharp, and proceed by train to Potter's Bar. Members will make their own arrangements for lunch. Hot tea (without food) will be provided at 3.30 p.m., and members are advised to bring their own drinking cups. The Battalion will entrain at Potter's Bar for the return journey at 4.40 p.m. A sketch of the ground, by Mr. Marples, will be issued to all Company Commanders.

Musketry.—Inter-Platoon Competition.—Acton Range will be open on Saturday next, the 8th inst., for practice for above competition, only for those men who have sent their names in to the Musketry Staff. Parade in Uniform, at Acton Range, at 2 p.m. punctually.

A. G. JOINER, *Major and Adjutant*, O.B.C.

British Trade in China.—A Reuter dispatch from Shanghai says that a Chamber of Commerce has been formed embracing the whole of China. It is issuing journals in English and Chinese, and is receiving most valuable co-operation from the Consular officials. The *Chamber of Commerce Journal* announces the formation of a school to teach the Chinese language to Englishmen. Shanghai is at present in the throes of a rubber boom.

Inquiry.—Makers of electrical conduit bearing the mark of a thistle are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. PERCY LANE, mains assistant at the Finchley electricity works, has tendered his resignation.

The Leeds Electricity Committee has recommended the City Council to advance the salary of Mr. C. N. HEFFORD, engineer and manager of the undertaking, from £600 to £800 per year.

Mr. J. B. FELTHAM, chief assistant at the Gloucester Corporation electricity works, has been appointed electrical engineer to the Mexborough U.D.C.

The Manchester Electricity Committee has decided to recommend that Mr. A. E. MCKENZIE, chief assistant engineer, be appointed deputy chief engineer at a salary of £700 per annum, rising by annual increases of £50 to £800 per annum as the maximum.

The National Electric Construction Co. have appointed Mr. H. C. BABB to be engineer and manager of their electricity works at Bo'ness, in succession to Mr. Rogers. Mr. Babb went to Bo'ness from Hawick, where he acted as chief technical assistant to the Edmundson's Electricity Works. On leaving Hawick recently he was presented with a case of pipes.

Mr. J. E. M. STEWART, chief assistant engineer in the Leicester electricity department, has resigned his appointment in consequence of ill-health. The engineer has been authorised to obtain the services of an assistant at a salary of £300 per annum.

Mr. T. S. WARTERS has resigned his position as shift engineer at the Regent's Park station of the St. Pancras Borough Council.

General.—Mr. A. VINES (formerly Schneider), a British-born subject, a managing director of Messrs. Evershed & Vignoles, Ltd., has by deed poll, dated December 31st, 1915, abandoned his former surname of Schneider and adopted and will use henceforth his mother's maiden name of Vines.

Mr. H. G. W. HASLETT, of Messrs. Haylock & Haslett, joined the London Electrical Engineers early in October last, and is now engaged in coast defence work with that corps. A dissolution of partnership has been deemed advisable, which will date from January 1st, 1916. The business will be continued under the original title of Ralph H. Haylock & Son.

Mr. WALTER TOWERS, lately mechanical engineer at Stirling Corporation electricity station, has obtained an important appointment at Rosyth Naval Base. Mr. Towers, who left Stirling about two months ago, offered his services to the Admiralty, who gave him a position at the Base, and he has since been promoted supervisor of the main power station. Mr. Towers was employed by the Stirling Corporation for 13 years.

Dr. WM. GARNETT, the well-known education authority, mathematician and physicist, retired from his position as Educational Adviser to the L.C.C., on reaching his 65th year, on December 31st.

In the *London Gazette* appointments there appear the following announcements:—December 15th, 1915. Admiralty; Electrical Engineer in H.M. Naval Establishments, Ernest Thomas Williams; December 17th, Richard Wightman.

The marriage took place at Hollingworth Congregational Church, on December 27th, of Mr. WALTER AGUTTER, of the electrical staff of the D.P. Battery Co., Bakewell, and Miss M. Marshall, of Woolley Lane, Hollingworth.

The *Morning Post* states that Mr. E. MANVILLE, of London and Coventry, president of the Associated British Motor Manufacturers and ex-president of the Society of Motor Manufacturers and Traders, has consented to serve as a member of the Board of Referees in connection with the excess profits duty.

It was announced in the *Times* last week that a marriage would shortly take place between Mr. HORACE FIELD PARSHALL, of Penbury Grove, Penn, Bucks, and Miss Ellen Dunlap Payne, daughter of Mrs. Gertrude Dunlap Payne and the late Frederick William Payne, of Boston, Massachusetts.

Mr. F. W. MOZLEY, eldest son of Mr. H. Mozley, the Burnley tramways manager, has enlisted in the Engineering Company of the London Regiment of Artists' Rifles. He is chief engineering assistant to the Burnley Corporation.

The daily Press states that Mr. G. W. J. PRAAT, traffic superintendent, Bournemouth Telephone District, has been appointed superintendent of telegraph and telephone traffic in the Ceylon Post Office.

Major C. W. JORDAN, electrical engineer, of Cardiff, has just taken over the duties of Commandant of the No. 7 Area of the Western Command. In this area there are Lancashire, Cheshire and Manchester, as well as Glamorgan companies.

Roll of Honour.—Second-Lieutenant WILFRID C. HUNTER, R.G.A., who was killed in action on December 30th in Flanders, was, prior to the war, secretary of the Rugby Lamp Co., Ltd. It is only a few weeks since he took leave of his parents and friends in Rugby to proceed to the Front.

Warrant Telegraphist HARRY NOBLE, of the R.N.R., has received the Serbian gold medal for zealous service in the

war, the conferment having been made at the instance of King Peter.

Sapper ARTHUR E. PHILLIPS, signaller in the Royal Engineers, formerly an electrical engineer at Bradford, is on sick furlough at his home suffering from diabetes.

Private HAMER, of the 16th Lancashire Fusiliers, formally employed at the Westinghouse Works, Trafford Park, has been killed by the explosion of a mine under a trench in France.

Private J. L. HORNE, of the 1/6th Battalion Manchester Regiment, who prior to the war was an apprentice electrical engineer at the Westinghouse Works, Manchester, and previously reported missing, is now reported to have been killed at the Dardanelles.

Sapper HARRY ASHCROFT, of the County Palatine Engineers, who has died in hospital at Rouen, France, from pneumonia, contracted whilst engaged on trench work, was until last March engaged as an electrician at Southport.

Sapper TOM GRANTHAM, who has been wounded on three occasions, and is now home on leave from France, was prior to the war an electrician at Blackpool Tower.

Private ALBERT T. SCOTT, 3rd Buffs (East Kent Regiment), who is reported wounded and a prisoner of war, was on the staff at the power house of the Associated Portland Cement Manufacturers, Ltd., at Burham, near Maidstone.

Lance-Corporal CLAUD BANCROFT, of the 4th Battalion West Riding Regiment, who is in hospital at Sheffield suffering from serious injury to his ears through the bursting of a trench mortar, was engaged prior to the war as electrical engineer on board Mr. George Jay Gould's yacht *Atalanta*, which is now doing patrol duty in connection with the Navy.

The Salford Tramways Committee has passed a resolution congratulating Sergeant SMETHURST, an employé of the Committee, on being awarded the D.C.M., and has given instructions for the resolution to be engrossed on vellum and presented to Sergeant Smethurst.

Will.—The late Dr. F. S. PEARSON, who was drowned in the *Lusitania*, left estate valued at £328,960 in the United Kingdom.

New Year Honours List.—In the New Year Honours list the following appear:—

MR. D. A. THOMAS, of South Wales Colliery fame, who has lately rendered valuable assistance to the Ministry of Munitions by his visits to America, has the dignity of a Barony of the United Kingdom conferred upon him.

MR. G. N. BARNES, M.P., formerly Secretary of the Amalgamated Society of Engineers, is to be sworn a member of the Privy Council.

SIR GEORGE BULLOUGH, of Messrs. Howard & Bullough, engineers, and MR. A. F. YARROW, the shipbuilder, are made Baronets.

MR. GEORGE FRANKLIN, who was formerly chairman and managing director of the National Telephone Co., Ltd., is made a Knight, as are also Mr. H. F. LE BAS, of the Caxton Publishing Co., and Mr. R. A. ROBINSON, a former chairman of the L.C.C.

In the Colonial Honours list, COLLINGWOOD SCHREIBER, ESQ., C.M.G., general consulting engineer to the Government of Canada, becomes a K.C.M.G.

MR. J. R. BOOSE, travelling commissioner for the Royal Colonial Institute, is made a C.M.G.

Mr. W. W. HOY, general manager of Railways and Harbours, Union of South Africa, and Mr. JOHN KENNEDY, consulting engineer to the Montreal Harbour Commission, each receive the honour of Knight Bachelor.

The Kaisar-i-Hind Gold Medal awarded for public services in India is given to Mr. W. S. SHARPE, Indian Telegraph Department, Superintendent of Telegraph Engineering, Bombay Division, and to Mr. H. J. H. GLENN, executive engineer, Province of Delhi.

NEW COMPANIES REGISTERED.

Temple Brothers, Ltd. (142,541).—This company was registered on December 24th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, electrical, mechanical, motor, telephone, heating, ventilating, and general engineers, makers and repairers of and dealers in electrical and other fittings, telephones, indicators, fire alarms, lightning conductors, automatic time recorders, clocks, time switches, electrical, scientific, surgical, nautical, optical, and mathematical instruments, manufacturers of and dealers in engines, aeroplanes, airships, motor cycles and cars, etc. The subscribers (with one share each) are: J. Hamilton, London House, New London Street, E.C., mechanical engineer; A. J. Seward, London House, New London Street, E.C., superintendent engineer. Private company. The first directors (to number not more than five) are W. J. Stewart (chairman) and J. Hamilton. Qualification, £50. Remuneration, as fixed by the company. Solicitor: C. Crowther, 23, Abingdon Street, Westminster. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dick, Kerr & Co., Ltd.—Capital, £650,000 in £1 shares (350,000 pref.). Return dated November 4th, 1915. 305,000 pref. and 260,000 ord. shares taken up; £565,000 paid. Mortgages and charges: £331,665

Bankfoot Power Co., Ltd.—A memorandum of satisfaction to the extent of £5,000 on September 30th, 1915, of debentures dated May 12th, 1911, securing £50,000, has been filed.

James Keith and Blackman Co., Ltd.—Issue, on December 20th, 1915, of £1,500 debentures, part of a series of which particulars have already been filed.

A memorandum of satisfaction in full on November 11th, 1915, of debentures dated February 9th, 1914, securing £1,500, has also been notified.

Northampton Electric Light and Power Co., Ltd.—Issue, on December 3rd, 1915, of £500 debentures, part of a series of which particulars have already been filed.

Buenos Aires City and Suburban Tramways, Ltd.—A memorandum of satisfaction in full on December 9th, 1913, of charges dated March 29th, 1911, and supplemental agreement dated September 4th, 1912, securing £64,000 and further advances up to £20,000, has been filed.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

THE annual meeting was held on December 30th at the Great Eastern Hotel, E.C., under the presidency of Mr. G. P. NORTON. In the unavoidable absence of the Chairman (Mr. R. M. Horne-Payne) Mr. HAROLD BROWN, a director, read a speech which that gentleman had prepared. In this the CHAIRMAN said that British Columbia had unquestionably suffered from the effects of the war very much more acutely than any other part of Canada. A commercial paralysis had resulted which had produced so great a falling-off in the receipts of the company that it was probable it would not earn in the current year much more than sufficient to pay its debenture interest. Fortunately the war did not find the company in a weak position as regards cash resources, and by immediately cutting down capital expenditure to the utmost possible extent and enforcing the most rigid economy, the position had been still further strengthened, and the company was now in a position to withstand even the present acutely bad times although they should continue for several years. Unfortunately, as events had turned out, they had extended the tramway system and increased their equipment and power plants largely beyond the requirements of the business at present available, and had, therefore, for the time being, large amounts of capital unremuneratively employed. For instance, their systems of power plants on the mainland and Vancouver Island had cost $13,475,000, and they were capable of producing about twice as much power as was required during the past year. The ordinary effects of the commercial depression had been greatly accentuated by the advent of an extraordinary form of competition in the jitney 'bus. With regard to the future of this competition, since the commencement of the winter rains there had been a considerable and continuous reduction in the number of jitneys operating, particularly in Vancouver. It was expected that this reduction would at least continue during the remaining winter months. What, however would happen in the spring, when the fine weather returned, it was difficult to forecast. The general manager held the opinion that they would not be troubled next summer with the jitney 'bus to the same extent as during the past summer. They had hitherto struggled to maintain a thoroughly efficient service throughout all the districts served by their cars, but should this jitney competition continue on an extensive scale, the company must cease to operate some of the outlying lines. At present the jitneys took the cream of the paying traffic in the more thickly populated centres, leaving the company to provide for the whole of the unremunerative business. It was impossible for the jitneys to supply the needs of the outlying districts at anything like the fares which the company charged, but if the people insisted upon supporting this unfair competition in the more thickly populated areas the company would have no alternative but to leave some of the outlying districts without travelling facilities. During the year every effort had been made to strengthen the company's friendly relations with the municipalities, and although the board had been compelled to refuse many requests involving expenditure of money, it was hoped that the municipal authorities were beginning to some extent to appreciate the company's difficulties, and that the interest and prosperity of the company and of the community were identical and inseparable, and this would undoubtedly be realised more and more after the war. The company's present position was extremely disappointing, but it was one that would right itself with the return of normal conditions. As the result of the wonderful crop, which was reliably estimated to produce to the farmers in the three prairie provinces alone no less than 400 million dollars, and of the stimulus given to every branch of manufacture by the increased spending power derived from it, and also from the large munition orders placed in Canada, a great revival of trade had taken place in the Eastern and Central Provinces, and would undoubtedly slowly extend to British Columbia. He might sum up the situation by saying that the company was suffering from what could only be described as tragically bad times, which had caused much suffering and had driven a quarter of the population out of the cities and had, incidentally, caused a greatly restricted use of the cars and of electric light, a reduction in the consumption of power by industrial enterprises, and had produced jitneys. He thought there was no

doubt that the worst was past. There was already a considerable improvement in the lumber trade, some increase in activity in mining, and the restoration of the Canadian Pacific steamship service to Japan and China was definitely announced, which afforded grounds of hopes of a more marked improvement when the winter was over. The Panama Canal and the Canadian Northern Railway across the continent to Atlantic tide water, both of which were completed in the last year, would prove most powerful factors in hastening the development of British Columbia on the return of normal conditions, and there was nothing in the situation which caused him to abate in the least degree his absolute confidence in the splendid future of the province, which could be hastened or retarded chiefly by the disposition shown by the people to treat capital with honesty and consideration or otherwise.

The CHAIRMAN formally proposed the adoption of the report, which was seconded by Mr. EVAN-THOMAS.

Replying to a shareholder, the CHAIRMAN said that with regard to the jitney competition, the board were of opinion that an ordinary motor-car could not possibly subsist for any length of time on the fares they were getting. It was, of course, possible that some form of vehicle would develop which would be a serious competitor with the trams, but up to the present the competition had come very largely from private owners who drove their own car and who were prepared to work inordinately long hours. The board had striven to get fair regulations for these cars, and he hoped they would succeed, but they had not been able to do anything up till now. As to the provision of £167,888 for renewals maintenance, the board thought it was in the best interests of the company that that provision should be continued as hitherto, and he might point out that it was only because they had put by such large sums in the past that the company was in its present very strong financial position.

The report was adopted.

Tata Hydro-Electric Co., Ltd.

THE directors, in their report to June 30th, 1915, state that in addition to the cotton and flour mills which have contracted to take supply from the company for a period of ten years, the company has entered into a contract with the Bombay Electric Supply and Tramways Co., Ltd., for energy required by them for two of their sub-stations, and the necessary plant for one of these has been ordered. The directors have authorised the investigation of new areas on the ghauts for the extension of the present scheme to meet any prospective demand for energy. Suitable sites have been chosen, and the result of the investigations shows that considerable power will be made available on a highly satisfactory basis. The general manager reports as follows:—

> The Walwhan dam was raised last season to a sufficient height to store water at full supply level. The work of completion is in progress. The water in this lake reached full supply level on September 10th, 1915. Water for power supply is being drawn from Lonavla lake since the commencement, and the lake now stands at only 4½ ft. below full supply level. The duct is nearing completion throughout. The Lonavla to Forebay section is in use, and the Walwhan section is being dressed, and is practically ready for service. The forebay work is practically completed. The sluice house, sluices, and all machinery are erected, and only a little finishing work remains. One upper pipe line and five small lower pipe lines are completed for the original installation. The valve house at junction point 9 is under construction. The tunnel between Walwhan and Shirawata is complete except for a little trimming, and a quantity of excavation has still to be done in widening the approach cut. Work is proceeding on the Shirawata Dam, and a small quantity of water is stored which will be utilised for construction purposes. A temporary weir is constructed for a small additional storage for power purposes next year. The power house work for the four units is practically completed. With the satisfactory conclusion of the necessary revision work on the generators the whole apparatus of the original installation will be soon in full service. The transformers, switchgear, etc., are all in regular use and giving satisfactory service. The transmission line is in working order, and both circuits are available to their full capacity. The question of insulators for maintenance is receiving attention.

The receiving station plant is all installed for the four units and working satisfactorily. For improving the power factor of the system two synchronous condensers have been erected during the year. The workshop building is completed and brought into use. The underground cables so far put into service are giving satisfaction. The major portion of the erection work is completed. Mill equipments for all the mills of the original installation are received. Ten mills are completely equipped and receiving power. Seventeen mills are receiving power for partial requirements. Load is being added continuously with due regard to the convenience of the customers. Arrangements are now being made for night supply of energy. At present there are 27 mills with motors of the aggregate B.H.P. of 27,400 in service.—*Indian Textile Journal.*

Western Canada Power Co.—It is announced, says the *Times*, that this company will default in payment of the coupon payable on January 1st on its five per cent. first mortgage bonds. A committee has been formed in Canada to protect the interests of the bondholders.

South Wales Electrical Power Distribution Co., Ltd.—The directors, in forwarding warrants for the current half-year's interest on the original debenture stock, state that, although at the present time there is in hand a sum sufficient to pay the now current half-year's interest, the whole of that sum was not earned in the half-year, a part having been previously accumulated.—*Financier.*

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended November 26th, 1915, amounted to 1,709,366, compared with 1,075,864 in the corresponding four weeks of 1914.

Kaministiquia Power Co.—The directors have declared a dividend of 1½ per cent. for the quarter to January 31st, or at the rate of 6 per cent. per annum.

STOCKS AND SHARES.

TUESDAY EVENING.

The first week of the new year has witnessed a good deal of firmness through the Stock Exchange. Prices all round are good, notwithstanding the fact that the public are buying comparatively little. The strength of the Consol market is a noticeable feature. Home Railway stocks are decidedly better. The industrial sections are more or less overshadowed by further robust developments in rubber shares, prices in that particular section going ahead with daily persistence, in consequence of a steady advance in the price of the raw stuff.

The turn of the old year released money, as usual, in the way of dividends, and also from the banking accounts of those who still indulge in the practice of window-dressing. Several Colonial new issues are in the air, and one of them has already made its appearance, but without exerting any effect upon investment prices, though in more normal times they would probably have depressed the gilt-edged securities to some extent. There is so much money awaiting investment that prices are well maintained, and it would be a simpler task to write out the names of fifty first-class stocks of which there is no supply, than to catalogue a list of similar length giving the names of those which can be bought at the present time.

The Home Railway market is enjoying one of its periodical spasms of firmness. Most of the popular stocks are better and a decided feature of the market is the buoyancy of Underground Electric Railway issues. The £10 shares, in particular, are strong; but the 6 per cent. income bonds have also advanced, and show a rise of 2¼ on the week. The improvement is due to inquiry on behalf of investors, of whom a large number are buying quite small amounts of the stock. Metropolitans and Districts are both harder, and Central London stocks—out of favour for some time past—are now wanted.

Hundreds of ex-dividend markings have been made within the past ten days throughout the Stock Exchange lists. Anglo-Argentine Tramways preference shares, and one or two of the debenture stocks are now ex dividend, and the company's first preference shares, at 4, look tempting to the speculative investor. British Columbia Electric preference moved up a point to 61.

The Mexican group is weaker. A few thousand dollars of Mexico Tramway and Mexican Light & Power bonds are on offer, although definite news from the country is as scanty as ever. Brazilian Tractions show a slight recovery, hardening to 51½, while other foreign Tramway descriptions are fairly steady.

The Telegraph market is very firm. Anglo deferred moved up to 23. Western Telegraph debenture stock has recovered a point of the interest deducted from the price. Globe preference are a trifle easier at 10¼. Marconis, now ex dividend, are quoted at 35s., and there is rather more disposition to deal in them again. The Heavy telegraph shares are all good, buyers predominating, and with very little floating supply on offer.

Home Electricity shares are no better. Illumination issues of all kinds are dull, gas stocks being weak equally with electricity supply shares. Westminsters have further receded. St. James' ordinary are back to 6. The market is stagnant; and although occasional bargains take place in the leading shares, this section ranks amongst those which have been unfortunate enough to fail in securing any portion of popular support since the war broke out nearly eighteen months ago.

British Westinghouse preference are strong at 2, in consequence of favourable rumours with reference to the big profits which the company is making out of war work. Babcock and Wilcox have also advanced further. Callenders are a good market at 11¼, showing a rise of 15s. on the week. India-Rubbers, at 8¾, are ex their dividend, and once more look cheap.

The rubber market is the name to conjure with for the moment. That there is a temporary shortage of the raw material seems to be generally recognised, but without affecting the rush for rubber shares. Those engaged in the business are pressed to the uttermost in order to keep up with the activity, which one of them declared only the other day to be anomalous and contradictory, what time the country is at war. Nevertheless, the public insist upon buying shares, the support coming from all parts of the country. By every canon of tradition and precedent, there should be abatement of the fever before long, and not a few Stock Exchange men look for a halt to be called. Still, as long as the strength of the raw rubber market is so pronounced, the public are hardly likely to want to part with their rubber shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Jan. 4, 1916.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	3½	—	7 2 10
do. do. 4½ Pref.	4½	3½	—	6 0 0
do. do. City Pref.	4½	3 xd	—	7 10 0
do. 4 Deb.	4	78	—	5 2 7
Chelsea	5	4½	—	5 17 8
do. 4½ Deb.	4½	87	—	5 8 6
City of London	9	12½	—	7 7 3
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 5 Deb.	5	98 xd	—	5 2 0
do. do. 4½ Deb.	4½	85 xd	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10½	—	5 17 8
do. do. 1st Deb.	4½	85 xd	—	5 5 0
do. do. 2nd Deb.	4½	83	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅞	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	—	7 1 2
do. do. 4 Deb.	4	75	—	5 4 0
Metropolitan	8½	5⅞	—	7 7 4
do. 4½ per cent. Pref.	4½	2¼ xd	—	6 18 6
do. 4½ Deb.	4½	85	—	5 6 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6	— ½	8 6 8
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70 xd	—	5 0 0
South London	5	3⅝	—	7 5 6
South Metropolitan Pref.	7	1 1/16	—	6 14 0
Westminster Ordinary	9	6	— ½	7 10 0
do. 4½ Pref.	4½	4	— ⅛	5 12 6
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	100¾	—	5 19 6
do. Def.	11½	28	+ ⅛	6 10 5
Chile Telephone	8	6⅛	—	6 3 0
Cuba Sub. Ord.	5	8	—	6 5 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12½	—	*6 8 0
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	128	—	*6 4 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅜	—	*6 12 2
do. Pref.	6	10½	— ⅛	5 17 1
Gt. Northern Tel.	23	83½	—	6 11 4
Indo-European	13	48 xd	—	6 15 4
Marconi	10	1¾ xd	—	5 14 3
New York Tel. 4½	4½	101	—	*4 9 1
Oriental Telephone Ord.	10	17	—	5 6 8
do. Pref.	6	9⅜	—	6 17 9
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	6	—	*7 12 5
do. Pref.	5	4⅜	—	5 8 1
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12⅜	—	*6 7 0
do. 4 Deb.	4	79 xd	+1	5 1 0
HOME RAILS.				
Central London, Ord. Assented	4	72½	—	5 10 6
Metropolitan	1½	25	+ ½	5 6 0
do. District	Nil	16½	+ ⅜	Nil
Underground Electric Ordinary	Nil	1⅝	+ 3/16	Nil
do. do. "A"	Nil	6/-	+6d.	Nil
do. do. Income	6	79½	+2½	*8 12 0
FOREIGN TRAMS, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	95 xd	—	5 5 0
Anglo-Arg. Trams, First Pref.	5½	4 xd	—	6 17 6
do. 2nd Pref.	5½	6⅝ xd	—	8 3 0
do. 4 Deb.	4	72½ xd	—	5 6 8
do. 4½ Deb.	4½	77 xd	—	5 17 0
do. 5 Deb.	5	81	—	6 4 0
Brazil Tractions	3½	51½	+ ½	6 16 0
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	85	—	5 3 0
British Columbia Elec. Rly. Pfce.	5	61	+1	8 4 0
do. do. Preferred	—	40	—	Nil
do. do. Deferred	—	40	—	Nil
do. do. Deb.	4½	64	—	6 12 10
Mexico Trams	Nil	40	−2	Nil
do. 5 per cent. Bonds	—	49	—	Nil
do. 6 per cent. Bonds	—	48	—	Nil
Mexican Light Common	Nil	29	−1	Nil
do. Pref.	Nil	40	−2	Nil
do. 1st Bonds	—	47	—	—
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2 7/16	+ 1/16	5 15 0
British Aluminium Ord.	5	22/6	—	4 9 0
do. Pref.	6	18/-	—	6 13 4
British Insulated Ord.	15	10½	—	7 2 10
do. Pref.	6	5⅝	—	5 11 7
British Westinghouse Pref.	7½	40/-	+1/6	7 10 0
do. 4 Deb.	4	69	—	5 14 10
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11½	+ ¾	6 11 4
do. 5 Pref.	5	4½	—	5 17 8
do. 4½ Deb.	4½	90	—	5 0 0
Castner-Kellner	20	8	—	6 13 4
Edison & Swan, £3 pd.	Nil	9/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	60 xd	—	6 13 4
do. do. 5% Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	—	8 11 6
do. do. Pref.	7	19/9	—	7 1 4
Gen. Elec. Pref.	6	9½ xd	—	6 3 1
Henley	20	18½	—	*8 12 6
do. 4½ Pref.	4½	4½	—	5 6 0
do. 4½ Deb.	4½	99	—	4 17 9
India-Rubber	10	8⅞ xd	+ ½	*13 1 2
Telegraph Con.	20	31½	—	*8 1 0

*Allowance made for dividends being paid free of income-tax.

Kent Collieries Closed.—The *Times* states that, owing to scarcity of labour and transport difficulties, the directors of the Kent Collieries have decided to suspend operations until after the war.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	1/2	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	"	..	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£25	..
a Copper Sulphate	"	£45	30/- inc.
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/5	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	..	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	..	..
a " Chlorate	per lb.	1/4½	..
a " Crystals	per ton	60/-	15/- inc.
a Sodium Bichromate, casks	per lb.	8½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots	"	..	..
b Babbitt's metal ingots	"	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/9½ to 1/2⅝	¾d. inc.
c " Tubes (solid drawn)	"	1/8 to 1/8½	½d. inc.
c " Wire, basis	"	1/2⅝ to 1/2⅝	¾d. inc.
c Copper Tubes (solid drawn)	"	1/8½ to 1/8½	¾d. inc.
g " Bars (best selected)	per ton	£119	£7 inc.
g " Sheet	"	£119	£7 inc.
g " Rod	"	£119	£7 inc.
d " (Electrolytic) Bars	"	£103 10	£7 10 inc.
d " " Sheets	"	£126 10	£7 10 inc.
d " " Rods	"	£115 10	£7 10 inc.
d " " H.C. Wire	per lb.	1/2	½d. inc.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	1 10	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	4/1	9½d. inc.
i Iron Pig (Cleveland warrants)	per ton	79/-	1/- inc.
l " Wire, galv. No. 8, P.O. qual.	"	£28	..
g Lead, English Pig	"	£31 15	35/- inc.
g Mercury	per bot.	£16 15	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
g Phosphor Bronze, plain castings	"	..	..
g " " rolled bars & rods	"	..	..
g " " rolled strip & sheet	"	..	..
e Platinum	per oz.	210/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	"	£174 to £175	£7 to £8 inc.
n " Wire, Nos. 1 to 16	per lb.	2/8	..
g White Anti-friction Metals	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

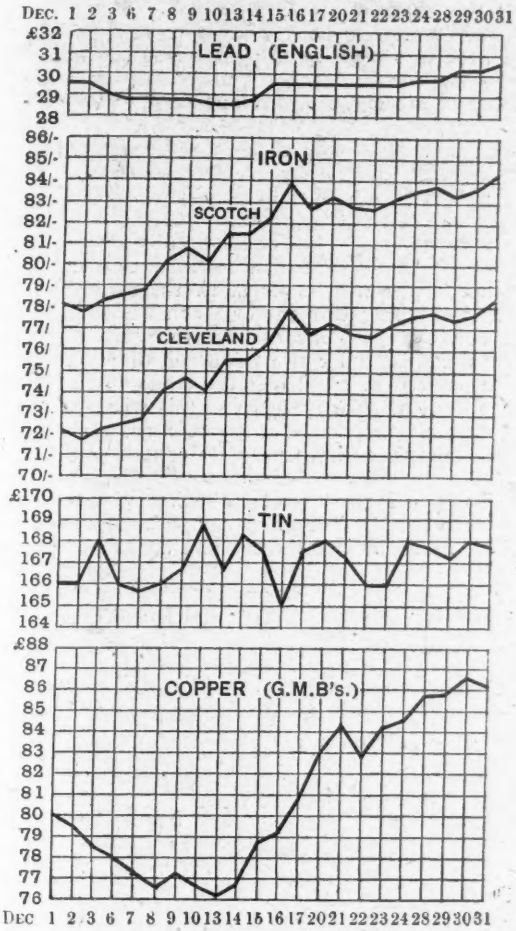
a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Electro-Harmonic Society.—Mr. C. B. Clay will preside at the smoking concert which is to be held to-night at the Holborn Restaurant (King's Hall), at 8 p.m. The artistes are announced as follows:—Mr. Philip Ritte, tenor; Mr. George Baker, baritone; Mr. W. H. Squire, violoncello; Mr. Alan Stainer, ventriloquist; Mr. Leslie Harris, sketches at the piano; Mr. Harry May Helmsley, cartoonist and imitations of children; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Cobalt and its Uses.—Extensive deposits of cobalt exist in Canada, but the metal, which resembles nickel, is more expensive than the latter; nevertheless, it possesses advantages for electro-plating purposes, and recently it has been found that an alloy with iron, containing cobalt to the amount of one-third, has a very high magnetic permeability, much higher than that of pure iron or transformer steels, while the hysteresis loss is as low as that of commercial steels. The alloy, however, is brittle and costly.

METAL MARKET.

Fluctuations in December.



Electrical Work in British India.—The following information regarding openings for trade in British India is extracted from the review of the trade of India in the past year. The Director of Statistics to the Indian Government recently reported:—"Electrical machinery for use in connection with water-power plant has great capabilities of expansion. The total number of electrical installations in India is already large, and is increasing. All the larger towns and chief ports possess electric light and electric tramways, or are about to use power for these purposes. A gradually increasing market for electrical machinery is anticipated. In recent years the collieries of India have largely adopted electrical equipment, and here German goods have found an opening. The Calcutta market has in late years been flooded with cheap German materials for electric wiring, such as cables, switches, ceiling roses and cut-outs. Since the outbreak of hostilities this source of supply has ceased, and the United Kingdom is likely to capture the German trade in these goods, provided the requirements of the market are carefully studied."—*Board of Trade Journal.*

Australian Electrical Contract Conditions.—A beneficial effect directly attributable to the amalgamation of the New South Wales and Victorian Electrical Engineers' Associations was reported to the Victorian Branch, last week, by Mr. W. J. Newbigin, who represented that Branch at a conference with the Federal Council of the Electrical Association of Australia. As a result of that conference, model contract conditions have been evolved, which, although differing in several respects from those now made by Government and municipal engineers, will almost certainly be adopted by those officials. They have already been approved by representatives of the electrical contractors. The conditions were drawn up a few days ago in Sydney by a committee, including the chief engineer of the Sydney tramways, the city electrical engineers of Sydney and Melbourne, a New South Wales Government assistant electrical engineer, an electrical contractor, and a consulting engineer, all of whom are on the Electrical Association's Federal Council. No such arrangement could have been arrived at, Mr. Newbigin said, but for the amalgamation.—*Australian Mining Standard.*

MUNITIONS AND LABOUR.

(COMMUNICATED.)

THE year 1914 will ever be remembered as the year of the outbreak of the great war; the year 1915 will be remembered as the year of muddle by the Government and "squabbles" among the "powers that be," but the capital error that stands out in high relief among all the muddling is the way in which the Government has obeyed the dictates of the Labour leaders. To any business man it is pitiful to see members of the Cabinet appealing to the representatives of Labour not to ask for any further advance in wages, as the country cannot afford it. The manner in which the South Wales miners defied the Government in the early part of the year, the spectacle of munition workers going to prison rather than obey the laws of the country, and the Minister of Munitions begging the workmen to allow women workers to assist the country in its great need, can only be characterised as disgraceful. It is sad to think that men claiming to be citizens of this great Empire, in a time of stress, and when their brothers are fighting for their lives in the trenches to defend the hearths and homes of those left behind, should act in such a mean and selfish spirit, as if the only thing that mattered was to guard what they claim as their legitimate rights and privileges. It is, however, worse to know that this state of things is due mainly to the Government pandering to the demands of the Labour leaders in the past, and thus giving a loose rein, and even encouragement, to the propagation of Socialist fallacies, which teaching can only lead to anarchy. The duty of the Government was and is to guard and defend the liberty of the individual, whether he be workman or master.

The whole question has now become of vital importance—not only at the present time when the country is in danger, but also in the future—for there can be no doubt that, after this terrible war, the strife between capital and labour will become extremely acute, and it behoves every sensible man, whether he be employé or employer, to try and find some solution. It is no use blinking at facts, as business men have been obliged to do for some years past in their desire to make the best of the situation, whilst they saw Germany moving forward by leaps and bounds, wresting the markets of the world from them bit by bit. It is not generally known, but it is a fact nevertheless, that the great British coal trade, the staple of our industries, in so far as the export trade was concerned, would, in the course of time, have been controlled by German coal merchants, and it is well enough known how the German tentacles were reaching out to control the electrical industry.

Returning, however, to the point at issue, the latest move on the part of Labour is the amalgamation of three important trade unions, viz., the Miners' Federation of Great Britain, the Railway Workers' Union, and the Union of Transport Workers. To put it bluntly, its one object is to paralyse industry, and to put pressure on the British public to compel the employers to grant the demands of the members of any one of the unions. And it is highly probable that they expect to gain support from the Government, as they did—and obtained it—in the national coal strike. What is to be the outcome of all this combination for POWER? which, so far as the liberty of the individual is concerned, is equally as bad as, or worse than, German militarism, which we are now sacrificing blood—the best blood in the country—and treasure to break. It is noteworthy that the greatest opponents to conscription in this country have been the Labour leaders, yet as regards their own particular trade unions they put into operation the vilest form of conscription, and it is well enough known that many members of the unions are only members through sheer terrorism. Britain has ever been known as the land of freedom, and, politically speaking,

it still is, but it would appear that we are fast giving up our birthright for what is neither more nor less than trade union slavery.

One has become so accustomed to dealing with trade union officials that the individualism of the employé is wholly lost, and many employers are afraid to give any man work unless he is a member of the union. Other employers of labour have come to the conclusion that all workmen ought to be members of their union, and that all employers ought to belong to an employers' association. It has practically come to this. But one may ask, where is the boasted liberty of the individual? Again, what has been the effect of the power of the unions? Its acknowledged evils are slackness and defiance of all authority, even the authority of the trade union leaders themselves. But it sinks deeper than this. It has become a national curse in its effects upon the youth of the country, and the recent troubles between capital and labour, defiance of all law and order, wilful restriction of output—which even Mr. Lloyd George has at length had to admit—are but the fruits of want of discipline in the past. Bernhardi says in his "Germany and the next War," "The English nation, under the influence of growing wealth, a lower standard of labour efficiency—*which, indeed, is the avowed object of English trade unions*—and of the security of its military position, has more and more become a nation of gentlemen at ease and of sportsmen, and it may well be asked whether, under these conditions, England will show herself competent for the great duties which she has taken on herself in the future." Again: "We must never forget this. Hard, laborious work has made Germany great; in England, on the contrary, sport has succeeded in maintaining the physical health of the nation; but by becoming exaggerated, and by usurping the place of serious work, it has greatly injured the English nation." Unfortunately every word is true, and we question whether there is a single person—except, perhaps, a Labour leader, whose livelihood depends mainly on slackness and restriction—who would attempt to deny it. Is it any wonder the Prussians thought us "contemptible?" One is almost inclined to say, "Thank God for the war," as it has at least arrested us on the way to destruction.

For years past it has been well enough known to employers that restriction of output, and restriction alone, was ruining every industry in the country; and the wail of every coal owner is not so much against the Minimum Wage and the Eight Hours' Acts, as Acts of Parliament, but the fact that in each case the output decreased after the Acts came into operation. The higher the wages the less the work, the greater the cost of production, and the greater defiance to law and authority by the workmen. Yet the Government would not accept the owners' explanations, or believe the facts which were placed before it, but forced the men's demands upon them. These inevitably reacted on the public purse, and the great British public wondered why! Will this same great British public realise now, that the British workman, and especially the British miner, is neither more nor less than a spoilt child, petted and pampered by a weak Government until he is no longer fit to "fend for himself," and whose constant cry is "we *will* have more wages," without any thought for others, or the least exercise of intelligence by asking himself the question as to where they are to come from? He either cannot, or will not, realise that wealth is the result of production, and that if he refuses to produce there can be no wealth to distribute. To-day we are spending at the rate of £5,000,000 a day, and it has been estimated that at least £1,000,000 a day might be saved were it not for the evils of restriction in the past, and it is believed that at least 15 to 20 per cent. more coal could be produced per day in the coal mines of Great Britain if each workman would but do his best. The valiant Labour leaders will say this is a vile calumny on the British working man. Rubbish! It is true; and no one knows better that it is true than the Labour leader, but it is his profession to support methods and ideas which are fast sapping the very manhood from the British nation. That there are some splendid workmen no one would for a moment attempt to deny. This country would not have been in such a good position as she is to-day were it not for that fact, together with the patience and long-suffering of the employers. These men, however, have no great love for the trade union official, and thousands of them have emigrated to the Colonies where they are free to exercise their skill and ambition untrammelled by the rules and regulations of the "delegate," "shop steward," or "local secretary." England a free country—Free! When the Minister of Munitions must ask the "shop steward" if he will kindly allow the owners of the works to employ women; or when half-a-dozen pit lads can stop a concern involving thousands of pounds capital and cause hundreds of workmen to lose a day's pay. And it is the trade union leaders at the head of such freedom as this who aim at becoming the Government of the country, and who can claim the right to have absolute control of "all the means of production and distribution." Better the success of German arms! The iron heel of Prussianism would be lighter in comparison, than to be subject to the abject slavery and decadence of present-day trade unionism.

If, however, we are wise and take to heart seriously the lessons the past has taught us, and every man, whether employer or employé, will form a New Year firm resolution to do the very utmost for his country and incidentally for himself, it may yet prove that the greatest folly Germany ever committed was when she went to war.

TIPS FROM CHINA.

By George R. Archdeacon, A.M.I.E.E.

Four months ago I wrote a few hints which I hoped might prove useful in assisting British manufacturers in their attempt to obtain the German trade formerly done with China.

Since writing that article I have so frequently been asked for information about the Chinese workman that I am now attempting to set forth a few of the most common characteristics of what is, perhaps, the most complex type of humanity in existence.

All too frequently the newcomer is apt to take the peculiar Chinese temperament for granted without in any way trying to understand it. It is in this manner that opportunities of progress are so often missed, for a deeper knowledge of the native mind would naturally lead to a clearer understanding and a wider sympathy, which would be of inestimable value in assisting the Britisher in his financial dealings with the Chinese, whom I have often heard described as "the first gentlemen in the Far East."

Let me warn all British engineers and representatives that, although we may not find the Chinese of interest, the Chinese, from the moment of our arrival, will subject us to such scrutiny that before we are aware of it they will have our character so well summed up that they will be able to trick us and play upon our pet foibles and weaknesses in an amazing manner.

They will carefully watch us and plumb the depths of our knowledge until they are convinced whether or not we "savey our pidgin," and if they find us wanting we shall earn to the full their deepest contempt, for the Chinese are thorough. It may be only in one direction, but in that particular direction they soon acquire an almost uncanny aptitude in the application of that one quality.

"First impressions are lasting," therefore we have to find some method of impressing the Chinese. A good way is to get him "tied up" on some piece of work in which we are particularly expert, go to his rescue, for once condescend to take our coat off, and show him how it should be done, most carefully seeing that we do it correctly, after which we must patiently explain the whole process, meanwhile commenting on the simplicity of the operation.

In this manner we shall have benefited him and shall have secured his profound admiration for our skill and knowledge, the advertising of our wonderful capacity will be for ever established, and we shall be listened to with all the credibility of a veritable Solomon.

Chinese foremen are usually referred to as "No. 1." The author has generally found that it pays to learn the man's name, and address him by such, as it implies a greater interest in, and familiarity with, him, which is instantly observed by the other workmen, thereby engendering greater authority for our "No. 1."

Perhaps one of the most extraordinary differences between the British and Chinese foreman is the manner in which each regards his job. The former is apt to consider it a great calamity to lose his berth, whilst the latter would prefer to lose a dozen berths rather than lose his dignity.

If at any time we arrive on a job and find the work in progress being wrongly executed, on no account should we lose our temper with our "No. 1" (if we value his services). We must explain with firmness that we object to that method, and order whatever alterations we consider necessary to be immediately undertaken.

If by any chance we had lost our temper and reprimanded our "No. 1" before the men, he would have "lost face," and would most probably say:—"Master, I no can stay more, better you makee pay me, I go catchee new pidgin." The correct mode would have been to screw down the safety valve and wait until we had the "No. 1" in the office, and there let the steam "blow off" to our heart's content.

The author has had experience of workmen in about six different countries, and he is of the opinion that, man for man, the Chinese workman will compare very favourably with the best skilled men in Europe. There is, however, one grave fault with Chinese labour—greater supervision is needed. Frequently the Chinese workman will be engaged for weeks upon repetition work, and will work in strict accordance with his instructions, when, suddenly, without any apparent reason, some curious kink in his mind will cause him to depart from his former method and adopt an entirely new one.

From time to time one hears a great deal about the terrible vice of opium smoking; upon closer acquaintance, however, it is found to be no more terrible than the alleged habit of the British workman of dropping into a convenient "pub" and coming out drunk.

The Chinese are, without doubt, amongst the most frugal and thrifty people in the world, and, with the exception of the various religious festivals, they will never lose time if they can possibly crawl to work. What would not the Minister of Munitions be able to do with such men!

In all intercourse with Chinese in superior stations in life the Britisher should not make the mistake of talking "pidgin English." A Chinese merchant takes it as a compliment if we speak to him in "pukka" English. He may not understand half we say, but he will smile blandly upon us, feeling that we are treating him as an equal, and not as a member of the coolie class.

It may, or may not, come as a complete surprise to many readers when we tell them that China is the home of Trade Unionism. The Chinese have probably forgotten more about the ethics of trade unionism than the whole of the British Labour Party ever knew! Everyone belongs to a trade union or a guild, as they are called—fitters, turners, tailors, shoemakers, nursemaids, washerwomen, house-boys, coolies, etc.—all have their separate guilds, and woe to the employer whose bad luck it is to be "black-listed." If our name does in time appear on this list, we shall slowly but surely begin to realise that our works are not running so smoothly as formerly, and our best men will leave and be replaced with some difficulty until we have appeased the powers that be.

BRITISH MANUFACTURERS AND FUTURE TRADE IN BELGIUM.

BY "BELGIAN."

A GOOD deal has been said and written about the extension of British exports to new fields of commercial activity, but although many schemes have been put forward, none has actually been accepted as a basis for such an extension. Up to the present manufacturers have been left to their own initiative, and that is where the trouble lies. It is not by independent efforts that a trade of any magnitude will be built up abroad; but it is by the co-ordination of ideas accepted by all, and followed by all, that a substantial and durable result will be attained.

An association of manufacturers—there is one for nearly every trade—was needed to keep up the interests of the Home market, and will be needed still more, after the war, to stop any new attempt at German competition. A similar organisation is needed to control the export of goods, and, if it be worked on a sound basis, it is bound to bring success.

But the manufacturers have got to make up their minds *now*, to form a board to consider, and take adequate measures to meet, the Continental requirements in the near future. Inquiries will then be pouring in asking prices for such-and-such materials, complying with the Continental Associations' and Supply Co.s' rules; and what will the answers of British firms contain? Will there not be offers of material made to the British standards and regulations, which is *not* what is required abroad, and will not do?

To point out the importance of my views, I may mention the following cases from my own experience:—

1. British-made china cut-outs (of an old type) were refused on account of their construction, when submitted to the Supply Co.—the type in question was made as nearly as possible to the Continental pattern.

2. A consignment of steel tubing by a well-known British firm, screwed to the Continental thread, had to be sent to a Belgian factory to receive the inside insulation required by all fire insurance companies. In my efforts to introduce the British article, I procured the necessary dies and tools from Germany, and had them sent over here at my own expense; but the cost of production and of insulation proved too much to compete against the German article.

3. The use of tumbler switches on a 220-volt A.C. circuit was objected to by the Supply Co.

4. The different Continental regulations and standards of output, well known here, but seldom applied, by the manufacturers.

The Board of Exports is required now, to prevent friction between dealer and manufacturer as regards the right article wanted, by making inquiries, and acquainting the trade with the results obtained, and to prepare for all emergencies that will arise. Another reason: We were dependent on Germany for a lot of articles that we did not make ourselves and that were too expensive to obtain in another country. We shall be confronted with the same problem after

the war. If the British-made article is found too expensive, the duty of the Association will be to advise the firms concerned to have the articles asked for—they are nearly all patented—made for them in an acknowledged factory in Belgium, so as to save the expenses of transport, customs duties, and also the delay in delivery. Such a policy would increase the profit of the patentee, but it would enable the article to be made at a price suited to the Continental market.

The Association would also communicate the market conditions prevailing at any time, also the financial terms accepted. The sending of money before the dispatch of the goods, as required before the war, will not do.

There are, no doubt, many more reasons for taking steps to form an association at an early date, which have already been made known by other writers in previous articles.

THE DESIGN OF HIGH-PRESSURE DISTRIBUTION SYSTEMS.

By J. R. BEARD, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *December*, 1915.)

(*Continued from Vol.* 77, *page* 863.)

Lay-out of Distribution System.—Except in special circumstances it is usually essential for each sub-station to have at least two separate sources of supply, and, if the supply to the sub-station is not to be interrupted by a failure of one source, some form of discriminating protective device must be installed on each feeder in order to isolate it automatically in the event of its breakdown. It is, however, not so generally recognised that it is of equal importance that a fault on one feeder must not interfere with the supply through the sound feeders however severe the fault may be. The only forms of protection in commercial use which meet these conditions under all circumstances are the balanced-current protective system with pilot wires and the split-conductor protective system. Both have the further advantage that the isolation of the faulty feeder is practically instantaneous and can be effected with quite a

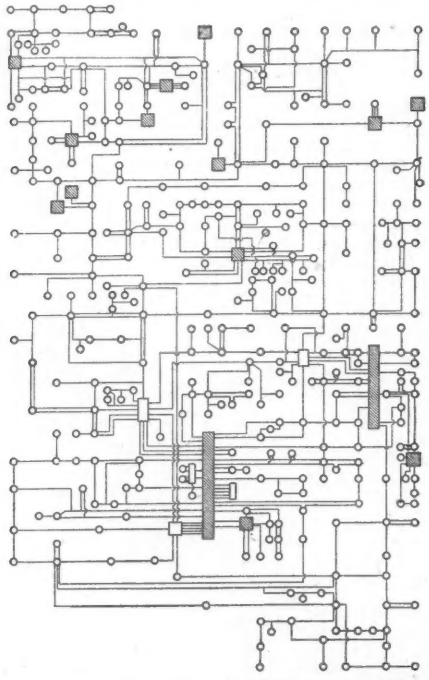


FIG. 7.—NORTH-EAST COAST HIGH-PRESSURE DISTRIBUTION SYSTEM. Generating stations shown cross-hatched.

low value of the fault current, so that the disturbance to the general system is a minimum. They increase the cost per mile of a main of given section, but this is counterbalanced by the saving effected by the possibility of using an interconnected system which allows of:—

(*a*) A reduction in the cost of mains due to the saving in spare feeders.

(*b*) A reduction in the cost of mains due to the possibility of replacing a number of small feeders by a few large ones which are cheaper per ampere of carrying capacity.

(*c*) A reduction in the amount of switchgear required.

(*d*) A reduction in the total annual cost of mains, owing to its being possible to take advantage of the diversity between the demands of different sub-stations.

The extent to which a system may be safely interconnected by the use of these devices is shown by fig. 7, which illustrates diagrammatically the high-pressure distribution system on the North-East Coast. No less than 350 sub-stations are connected to this system, and it is fed by 15 power stations, many of which utilise waste energy in the form of exhaust steam and coke-oven gas. The whole of the feeders shown are normally in commission and interconnected, the older ones being equipped with balanced-current protection and the more recent ones with split-conductor protection. As showing the reliability of both these forms of protection, the operating records of this system show that over a period of time, selected quite at random, faults occurred on 23 feeders equipped with automatic protection, and that in 22 cases the faulty feeder was instantaneously isolated without causing an interruption of supply to a single sub-station except in one instance, where the sub-station in question was given a non-duplicate supply through the faulty feeder. In the remaining case, although the protective gear operated satisfactorily, one of the feeder switches failed to open due to a mechanical fault; this was equivalent to a bus-bar fault and brought out the overload gear at two sectioning points, thus limiting the trouble to this section of the system.

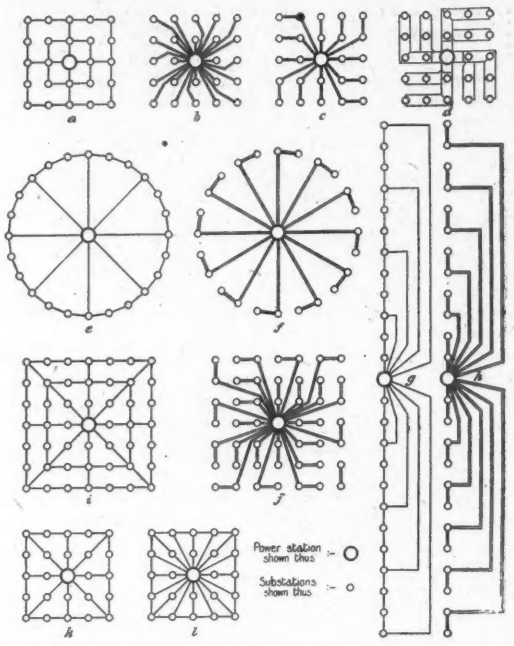


FIG. 8.—DIAGRAMMATIC LAY-OUTS OF DISTRIBUTION SYSTEMS.

In the following investigation an attempt is made to give definite figures for the saving effected by an interconnected system. These figures show that the saving is not only sufficient to balance the cost of the special protective devices, but that a system so equipped is actually cheaper than systems protected by less efficient methods which do not give the same freedom from interruption of supply.

In order that the results may be on the conservative side the extra cost of the special protective devices has been taken at 10 per cent. on the switchgear, including building accommodation, and at 2s. per yard on the mains, which is sufficient to cover the cost of balanced-current protection, and decidedly more than sufficient to cover the cost of split-conductor protection. In the first place, a comparison will be made between the three types of system that are available in the case of the supply to a number of sub-stations, the supply to which must be reasonably free from interruption. These are:—

(1) An interconnected system equipped with balanced-current or split-conductor protection, which ensures complete continuity of supply to all sub-stations in the event of a fault on a feeder.

(2) A simple radial system with duplicate feeders direct from the power station to each sub-station, equipped with time-limit overloads at the power-station end and reverse-power relays at the sub-station end. This limits the risk of interruption to the sub-station fed by the faulty feeder, and has been adopted for important supplies such as that to the London underground railways. Owing to the defects of the reverse-power relay, it cannot ensure complete continuity of supply to the sub-station affected.

(3) A series radial system with duplicate feeders to each sub-station protected as in (2), but with direct feeders from the power station to only half the sub-stations, each of these in turn feeding one of the remaining sub-stations. This involves graded overload gear, and a faulty feeder may shut down both the sub-stations in connection with it, and will probably shut down one of them; it is therefore only permissible where continuity of supply is not of such vital importance.

For the purpose of the comparison, a typical case is assumed of an area of 25 square miles with the power station at the centre and a sub-station with a maximum load of 500 KW. at 0.8 power factor and a load factor of 30 per cent. situated at the centre of each square mile, the distribution being effected by underground mains at 6,000 volts. It is assumed that owing to the diversity between the various sub-station loads the power-station load-factor will be 50 per cent., and the average feeder load-factor on an interconnected system, 40 per cent. The average maximum feeder currents are therefore deduced by assuming the sub-station maximum demand to be reduced in the ratio of the sub-station load-factor to the average feeder load-factor. This only holds for the interconnected system, but in the first instance the same reduced sub-station demands will be taken for other types of system, *i.e.*, the advantage which an interconnected system gains from its utilisation of diversity is neglected.

The annual cost per switch panel is taken from fig. 11, and the annual cost of the mains from fig. 6, the proper deductions being made in the case of types (2) and (3) for the omission of the special protective devices. Table I gives the comparison, while the diagrammatic lay-outs of the three types of system are shown in fig. 8 (*a*), (*b*), and (*c*).

TABLE I.

Type of system.	Reference to figs.	No. of switches.	Mileage of mains.	Annual costs. £	Percentage increased cost over interconnected system.
Interconnected ...	8 (*a*)	64	32·0	4,752	—
Simple radial ...	8 (*b*)	96	93·7	7,664	61·3
Series radial... ...	8 (*c*)	96	61·2	6,075	27·8

TABLE II.

Interconnected ...	8 (*a*)	64	32·0	4,752	—
Semi-duplicate "tee"	8 (*d*)	80	48·0	5,478	15·3
Change-over "tee"...	8 (*d*)	56	48·0	5,216	9·8

In certain cases where momentary interruption of supply is not of great importance a "tee" system has been used, arranged as shown in fig. 8 (*d*). Each sub-station is normally given a non-duplicate supply from one of the feeders, and arrangements are made for the sub-station to be changed over to the other feeder in emergency, thus involving a complete temporary interruption in the supply to all the sub-stations fed by the faulty feeder. In a modification of this system both tees into the sub-station are normally closed through switches equipped with time-limit gear, but the sub-station bus-bars are sectioned by a special switch. The sectioning switch may be either left open or it may be closed and equipped with instantaneous overload gear, so that it will immediately trip in case of a feeder fault. In either case supply is automatically maintained to half the sub-station bus-bars, and by opening the faulty feeder switch and closing the sectioning switch complete supply to the sub-station can be resumed.

Table II gives a comparison of these systems with the interconnected system, and it is interesting to note that the latter is still cheaper in spite of the great sacrifices in security entailed by the "tee" systems.

The foregoing comparison proves that the interconnected system is the most economical for the particular case which has been selected as typical; but in order to make the investigation complete it is necessary to show that this superiority still holds under other conditions, and accordingly the interconnected system will be compared with the cheapest system giving reasonable security of supply—the series radial system—under various modified conditions which may obtain in practice. These are:—

(1) The same number of sub-stations distributed one mile apart in a ring round the power station, or in line one mile apart with the power station at the centre, as shown in fig. 8 (*e*), (*f*), (*g*), and (*h*).

(2) The area of supply extended or decreased with the same number of sub-stations and the same total load on the system, *i.e.*, the sub-stations situated at the increased and decreased spacings of one per 4 square miles and four per square mile respectively, instead of one per square mile, the load per sub-station remaining the same.

(3) The area of supply extended to, say, 49 square miles with the same density of load and a correspondingly increased number of sub-stations supplied from the central power station, as shown in fig. 8 (*i*) and (*j*).

(4) The original distribution of sub-stations but with increased or reduced loads per sub-station, the alternative loads considered being 250, 1,000, and 2,000 KW. The arrangement of feeders remains the same for the series radial system, as a cable capable of dealing with the load of two 2,000 KW. sub-stations in emergency is not too large to be handled. For the interconnected system it is necessary to run more feeders from the power station to deal with the heavier loads, the feeder arrangements which would be adopted for the 1,000 and 2,000-KW. sub-stations being shown in fig. 8 (*k*) and (*l*) respectively.

The details of the comparison are given in Table III.

The outstanding features of this comparison are:—

(*a*) The economy of the interconnected system is generally maintained.

(*b*) The saving effected by an interconnected system rapidly increases as the area of supply is enlarged. This is important, as only relatively restricted areas have been considered.

(*c*) The saving is greatest for lightly loaded sub-stations and decreases as the sub-station loading increases. In the case of the most heavily loaded sub-station it would appear at a first glance that while the interconnected system may have other advantages, its direct economy is very small. This is only apparent, for in the first case the saving due to diversity has been ignored, and secondly it will be found on investigation that a point has been reached at which distribution at so low a voltage as 6,000 is uneconomical. With a sub-station loading as high as 2,000 KW. the distribution system costs 37.1 per cent. more at 6,000 volts than it would at 11,000 volts, while if a pressure of 11,000 volts were adopted the interconnected system would show a saving of 21.8 per cent. compared with a series radial system at the same voltage.

The possible further savings which may be effected if diversity is taken into account have been considered, and without going into details of the calculation it may be taken as adding something of the order of 4½ per cent. to the cost of a simple radial system, and rather less to the cost of a series radial system.

When comparing an interconnected system with other types, two further points must also be borne in mind.

(1) It is a very difficult matter exactly to forecast sub-station maximum loads or, as in the case of railways, definitely to fix the allocation between the various sub-stations. If the sub-stations are fed independently it is obvious that in proportioning the feeders to them allowance must be made for the assumed maximum loads being exceeded or varied, while if the sub-stations are interconnected, the particular distribution between the sub-stations does not greatly matter so long as the total system load is unaltered.

(2) The greater part of the saving effected by an interconnected system is in the trunk feeders, and in consequence it is more marked the farther the power stations are removed from the centres of load. In the above comparisons the power station has been taken at the electrical centre of gravity of

TABLE III.

Nature of modification to the typical system.	Type of system.	Reference to fig. 8.	No. of switches.	Mileage of mains.	Annual cost. £	Percentage increased cost over corresponding interconnected system.
Sub-stations distributed in ring	Interconnected	(*e*)	64	54·6	8,179	—
	series radial	(*f*)	96	115·9	10,977	34·2
Sub-stations distributed in line	Interconnected	(*g*)	66	84	11,508	—
	series radial	(*h*)	96	168	15,644	35·9
Sub-stations spaced one per 4 square miles	Interconnected	(*a*)	64	64·4	8,736	—
	series radial	(*c*)	96	122·4	11,103	27·1
Sub-stations spaced four per square mile	Interconnected	(*a*)	64	16·0	2,760	—
	series radial	(*c*)	96	30·6	3,562	29·0
Area of supply increased to 49 square miles	Interconnected	(*i*)	128	69·0	11,108	—
	series radial	(*j*)	192	166·9	16,135	45·2
Area of supply increased to 81 square miles	Interconnected	—	192	120·8	20,521	—
	series radial	—	320	347·7	33,124	61·4
Sub-station load reduced to 250 KW.	Interconnected	(*a*)	64	32·0	3,960	—
	series radial	(*c*)	96	61·2	5,295	33·7
Sub-station load increased to 1,000 KW.	Interconnected	(*k*)	64	35·3	6,533	—
	series radial	(*c*)	96	61·2	7,721	18·2
Sub-station load increased to 2,000 KW.	Interconnected	(*l*)	80	53·2	10,469	—
	series radial	(*c*)	96	61·2	10,572	1·0

the load and, therefore, at the least favourable position for the interconnected system.

So far the investigation has been limited to the comparatively low voltage of 6,000; but, speaking generally, the higher the system voltage the greater is the economy to be obtained by interconnection. This is obvious if it is remembered that—

(*a*) The higher the voltage the less is the proportionate cost of the protective devices, which is practically independent of the voltage.

(*b*) The higher the voltage the smaller is the section of the mains for given loads, and consequently the greater the advantage offered by interconnection in reducing the total length of mains and increasing their average capacity.

TABLE IV.

Distribution voltage.	Interconnected system.		Series-radial system.		Percentage increased cost of series-radial system over corresponding interconnected system.
	Reference to fig. 8.	Annual cost—£.	Reference to fig. 8.	Annual cost—£.	
6,000	(*l*)	10,469	(*c*)	10,572	1·0
11,000	(*k*)	7,634	(*c*)	9,295	21·8
20,000	(*a*)	7,984	(*c*)	10,756	34·8

This is shown very clearly by Table IV, which gives the comparison at various distribution voltages between the annual costs of interconnected and series radial systems for the typical distribution of sub-stations and a load of 2,000 KW. per sub-station.

(*To be continued.*)

A TRAGEDY IN LIMITATION.

BY "WHISTLEFIELD."

Extracts from the Price of Coal (Limitation) Act, 1915.
"An Act to provide for the limitation of the PRICE of Coal."

"WHERE coal is conveyed from any pit's mouth over any railway in trucks not belonging to a railway company, the seller of such coal shall not be entitled to charge for the use of the trucks any sum exceeding by more than 50 per cent. the sum which the railway company conveying the coal was actually charging for the provision of trucks at the commencement of this Act."

. . . . . .

"If in consequence of this provision the price to be paid by any consumer to whom coal is delivered is reduced by any amount, the price to be paid by any person to whom the coal is delivered in pursuance of any subsidiary contract shall be reduced by an EQUIVALENT amount."

. . . . . .

This Act shall not apply to any sale of coal for export . . . . or to any sale of coal to be used on any ship.

. . . . . .

ACT I. SCENE.—Engineer's office in electric light undertaking in London area.

ENGINEER (dictating): Write to Gilchrist, the coal merchant. Dear Sir,—Confirming my telephone conversation with you to-day, I have notified the colliery people that I intend to take advantage of the clause in the Price of Coal (Limitation) Act, whereby the coal contracts of electric light undertakings made between April 1st, 1915, and July 29th, 1915, are included in the scope of the said Act.

Write to the Colliery. Dear Sirs,—In terms of the Price of Coal (Limitation) Act, 1915, I beg to notify you that I intend to claim the benefit of the Act for the Dambad D.S. nuts contract made through Messrs. Gilchrist & Co. last June. I shall be glad to learn the amended price of this coal at the pit under the terms of the Act, and the amount of reduction which you will make to Messrs. Gilchrist on the present prices when the regulations come into force at the beginning of November.

ACT II. SCENE.—Engineer's Office, November 1st, 1915. Enter Gilchrist, the coal merchant.

ENGINEER, picking up a letter. I say Gilchrist, what's the nonsense about you not being able to make any reduction on the price of our coal? I notified you and the colliery people that we were going to claim it, and the three months allowed by the Act has expired, so I don't see how you can avoid making the reduction; besides, the colliery people have written to say that they are reducing the price to you by 1s. 6d. per ton. You don't think I got them to make a rebate for your benefit, do you? Why, the Act says you are to allow us an equivalent amount.

COAL MERCHANT: That's all very well; I don't deny that the colliery is giving me a rebate, but you can see from the details I gave in my letter that if I gave you 1s. 6d. per ton I'd lose money. My profit now is only 1s. 2d. per ton.

ENGINEER: The figures you give have got nothing to do with it; you contracted last June to supply me at 26s. per ton, and I don't suppose you do that at a loss. Well, then, because you are supplying it to an electric light undertaking, and I've claimed it, the colliery are compelled to reduce their price from this month by 1s. 6d. per ton, although the contract was made before the Act was passed. Freights haven't altered since you made the contract, so we are entitled to the 1s. 6d., and your profit per ton is exactly what it was before.

COAL MERCHANT: What about wagon hire?

ENGINEER: They are your own wagons; you are not charging yourself any more for their use, are you?

COAL MERCHANT: I'm entitled under the Act to charge 50 per cent. more on private wagons than the railway company charge for the hire of wagons. Their hire rate is 1s. 10d., and I'm entitled to add 11d. to that.

ENGINEER: But that doesn't apply in this case. If I'm fool enough to fix up another contract with you, you are allowed by the Act, in reckoning the maximum price that you propose to make, to add 50 per cent. on to the railway hire rate for the use of your own wagons, but in the case of an existing contract wagon hires don't come in at all.

COAL MERCHANT: The Act doesn't say so.

ENGINEER: No, of course not; but the Act was framed to limit the price to the consumer. That's why the colliery has to reduce the price, but it didn't intend you to pocket the reduction. Why, man; on your own showing, even if you had to hire railway trucks you would have been making a profit of 7d. per ton, and you propose to take another 1s. 6d.; 2s. 1d. per ton for merely passing on my order and invoicing up the goods.

COAL MERCHANT: That's less than the profit I'm allowed to make.

ENGINEER: How do you make that out? There's nothing about it in the Act.

COAL MERCHANT: I was with a deputation of coal merchants who waited on Mr. Runciman, and he told us that 10 per cent. was a very reasonable profit for the coal merchant. I admit that 2 to 3 per cent. is our usual profit, and I've booked contracts with large users, like yourselves, at 1d. a ton profit; but if Mr. Runciman thinks half-a-crown a ton most reasonable, it's not our place to argue the point, is it?

ENGINEER: But whoever suggested 10 per cent. to him? Did he inquire what the usual profit was?

COAL MERCHANT: No; when we asked him what he considered a fair profit for our work, he hesitated; and when our spokesman asked if he would consider 10 per cent. too much, he said he thought it very reasonable.

ENGINEER: Well, anyway, I'm going to have that 1s. 6d. per ton; it's allowed for by the Act, and if you won't deduct it I shall have to hand the matter over to the Town Clerk to settle.

COAL MERCHANT: The Act may have meant you to get that 1s. 6d., but it hasn't put it clearly, and I think you will find that the Town Clerk will agree with me that it won't stand in Court of Law, especially as the Act says that the decision of the Board of Trade will be final on any points not otherwise allowed for, and Mr. Runciman allows us 10 per cent. profit. I'd advise you to go and see him about it; he's a very nice gentleman to deal with—at least, we found him so.

ACT III. SCENE.—Engineer's office, a month later. Enter Gilchrist, the coal merchant.

ENGINEER: I say, Gilchrist, what's gone wrong with your coal deliveries the last three weeks? You are only putting in half your quantities; I've not more than four days' supplies in my bunkers, and if you don't send more along in a hurry I'll have to draw from my reserve stock. It cost 6d. a ton to put it into that store, and it will take 4d. a ton to wheel it into the bunkers; 10d. a ton added on to the price of the coal through your bad deliveries.

COAL MERCHANT: Don't blame me, sir; it's your precious Act that's responsible.

ENGINEER: How do you make that out?

COAL MERCHANT: Why, London is always a cut market for coal; the collieries can always get about 1s. a ton more for coal sent to the Midlands, and it's going there.

ENGINEER: But the Act doesn't allow them to charge two prices?

COAL MERCHANT: The Act allows them to add 4s. on to the prices they used to get, so the coal goes to the Midlands, and it's only when they have coal to spare that it comes to London. Just now the Midlands can take all that they can spare from the shipping trade. I've never known such a shortage of coal on the London market as there is just now, and it's going to be worse. The Act allows them to charge anything they like for export coal, and there is a big demand abroad; if they could get enough boats there'd be no coal to be bought in this country; it's the shortage of boats that enables you to get coal at all. A man 'phoned me yesterday and offered to pay one shilling or two shillings a ton above his contract price if the colliery would send him his full quantities, but they daren't take it; it's against the Act to charge more than they are doing. He'd have had to do without, like other people, if I hadn't arranged to buy a quantity from a coal merchant who is a friend of mine in the Midlands; that means he pays two coal merchants' profits, and the extra shilling the colliery charges for coal to the Midlands, and nearly double the railway freight. That is how your Act works for those who must have coal. It hasn't limited prices at all except in a very few cases, and some of the poorer grades of coal are actually up in price. We would all have been far better off without the Act. Here am I allowed to charge 10 per cent. profit and can't get coal to sell.

ENGINEER: Well, that doesn't help me; what am I to do when my reserve stock is used up?

COAL MERCHANT: You'd better ask Mr. Runciman.

(Exit the coal merchant and the engineer, the latter to take on a squad of labourers to wheel in coal from his store.)

TRADE STATISTICS OF CANADA.

THE following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1915, are taken from the recently-issued trade statistics. Figures for the year 1913-14 are given for purposes of comparison, and notes of any increases or decreases have been added:—

IMPORTS.

	1913-14. Dols.	1914-15. Dols.	Inc. or dec. Dols.
Railway passenger cars.—			
From United States ...	2,067,000	257,000	– 1,810,000
Motor cars for railways and tramways.—			
From United States ...	72,000	50,000	– 21,000
Copper wire, plain, tinned, or plated.—			
From United Kingdom ...	1,000	2,000	+ 1,000
,, United States ...	115,000	23,000	– 92,000
Electric light carbons and carbon points.—			
From United Kingdom ...	5,000	1,000	– 4,000
,, United States ...	39,000	36,000	– 3,000
,, Germany	40,000	6,000	– 34,000
,, Other countries ...	5,000	1,000	– 4,000
Total	89,000	44,000	– 45,000
Incandescent lamp bulbs, etc.—			
From United Kingdom ...	—	1,000	+ 1,000
,, Austria	14,000	8,000	– 6,000
,, Germany	—	4,000	+ 4,000
,, United States ...	110,000	54,000	– 56,000
,, Other countries ...	8,000	3,000	– 5,000
Total	132,000	70,000	– 62,000
Electric apparatus not mentioned (insulators, batteries, telegraph and telephone instruments).—			
From United Kingdom ...	809,000	538,000	– 271,000
,, Austria	2,000	2,000	—
,, France	29,000	9,000	– 20,000
,, Germany	141,000	68,000	– 73,000
,, Sweden	80,000	41,000	– 39,000
,, Switzerland ...	3,000	2,000	– 1,000
,, Italy	5,000	8,000	+ 3,000
,, United States ...	5,515,000	3,675,000	– 1,840,000
,, Other countries ...	13,000	1,000	– 12,000
Total	6,597,000	4,344,000	– 2,253,000
Manufactures of india-rubber and gutta-percha (except tires, clothing, and similar goods).—			
From United Kingdom ...	231,000	224,000	– 7,000
,, Austria	15,000	3,000	– 12,000
,, France	9,000	3,000	– 6,000
,, Germany	61,000	24,000	– 37,000
,, United States ...	776,000	621,000	– 155,000
,, Other countries ...	5,000	2,000	– 3,000
Total	1,097,000	877,000	– 220,000
Gasoline engines.—			
From United Kingdom ...	111,000	85,000	– 26,000
,, United States ...	2,457,000	1,905,000	– 552,000
,, Other countries ...	2,000	44,000	+ 42,000
Total	2,570,000	2,034,000	– 536,000
Steam engines.—			
From United Kingdom ...	50,000	67,000	+ 17,000
,, United States ...	386,000	170,000	– 216,000
,, Italy	19,000	—	– 19,000
Total	455,000	237,000	– 218,000
Steam boilers.—			
From United Kingdom ...	112,000	35,000	– 77,000
,, United States ...	273,000	163,000	– 110,000
Total	385,000	198,000	— 187,000
Concrete mixing, cement making, and coal handling machines.—			
From United Kingdom ...	32,000	7,000	– 25,000
,, United States ...	459,000	241,000	– 218,000
,, Other countries ...	4,000	1,000	– 3,000
Total	495,000	249,000	– 246,000
Asbestos manufactures.—			
From United Kingdom ...	50,000	33,000	– 17,000
,, United States ...	415,000	188,000	– 227,000
,, Other countries ...	9,000	6,000	– 3,000
Total	474,000	227,000	– 247,000
Electric motors, generators, and dynamos.—			
From United Kingdom ...	136,000	175,000	+ 39,000
,, France	4,000	2,000	– 2,000
,, Sweden	103,000	25,000	– 78,000
,, United States ...	1,542,000	1,146,000	– 396,000
,, Germany	14,000	—	– 14,000
,, Other countries ...	8,000	1,000	– 7,000
Total	1,807,000	1,349,000	– 458,000
All machinery not mentioned, except sewing machines, textile machinery, printing machinery, etc.—			
From United Kingdom ...	1,702,000	992,000	– 710,000
,, France	79,000	5,000	– 74,000
,, Germany	163,000	110,000	– 53,000
,, United States ...	12,811,000	8,091,000	– 4,720,000
,, Other countries ...	67,000	66,000	– 1,000
Total	14,822,000	9,264,000	– 5,558,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber, or other material, including cables so covered.—			
From United Kingdom ...	304,000	159,000	– 145,000
,, United States ...	563,000	175,000	– 388,000
,, Other countries ...	11,000	4,000	– 7,000
Total	878,000	338,000	– 540,000
Lighting fixtures of metal (including electric).—			
From United Kingdom ...	31,000	11,000	– 20,000
,, Austria	8,000	1,000	– 7,000
,, United States ...	637,000	401,000	– 236,000
,, Other countries ...	29,000	5,000*	– 24,000
Total	705,000	428,000	– 277,000
Plumbago, ground and manufactured.—			
From United Kingdom ...	14,000	4,000	– 10,000
,, United States ...	47,000	34,000	– 13,000
Total	61,000	38,000	– 23,000

* Germany, 6,000.

EXPORTS.

	1913-14. Dols.	1914-15. Dols.	Inc. or dec. Dols.
Mica.—			
To United Kingdom ...	36,000	32,000	– 4,000
,, United States	156,000	184,000	+ 28,000
,, Other countries ...	17,000	2,000	– 15,000
Total	209,000	218,000	+ 9,000
Electrical apparatus.—			
To United Kingdom ...	25,000	17,000	– 8,000
,, Newfoundland	9,000	16,000	+ 7,000
,, United States	67,000	49,000	– 18,000
,, Other countries ...	6,000	16,000*	+ 10,000
Total	107,000	98,000	– 9,000
Machinery (other than washing and sewing machines and typewriters).—			
To United Kingdom ...	84,000	40,000	– 44,000
,, Newfoundland	56,000	20,000	– 36,000
,, New Zealand	9,000	5,000	– 4,000
,, Argentina	9,000	21,000	+ 12,000
,, France	23,000	9,000	– 14,000
,, United States	729,000	188,000	– 541,000
,, Other countries ...	76,000	31,000*	– 45,000
Total	986,000	314,000	– 672,000
Gasoline engines.—			
To United Kingdom ...	—	7,000	—
,, Newfoundland	76,000*	94,000	—
,, United States	81,000*	13,000	—
,, Other countries	—	3,000	—
Total	88,000†	117,000	+ 29,000

* Australia $9,000, and Russia $11,000.

* Total exports. † Canadian manufactures only.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

NEW ZEALAND.—The text of the New Zealand "Finance Act, 1915," which was assented to in October last, confirms the amended rates of duty leviable on certain articles on importation into New Zealand which were proposed in the Resolutions introduced into the House of Representatives—*vide* p. 608 of the ELECTRICAL REVIEW of November 5th. Provision is also made in the Act that every Resolution passed on or after August 26th, 1915—the date from which the new duties take effect—and before the passing of this Act, purporting to impose any duties of Customs, or to create any exemptions from such duties, shall be deemed to have had the force of law, according to the tenor of such Resolution.

SWEDEN.—The exportation of copper (unmanufactured or raw) refined from raw material (not from scrap) at a Swedish refinery has been prohibited as from November 6th by a Royal Decree. The exportation has also been prohibited as from December 10th of carbon electrodes and carbon sulphide; ferro-tungsten (ferro-wolfram) and ferro-vanadium; wolfram and vanadium.

FINLAND.—In virtue of recent decisions by the Finnish Customs, the undermentioned arficles are to pay duty on importation into Finland as follows:—Electrodes weighing each 3 kilogs. or more are dutiable under Tariff No. 155 (1) at the rate of 1 mark (Finnish) 20 penni (say 1s.) per 100 kilogs. (220.46 lb.), while electrodes weighing each less than 3 kilogs. are dutiable under Tariff No. 231 (2) at the rate of 12 marks (say 9s. 7d.) per 100 kilogs. Fastening arrangements for electro-technical machines (not being an integral part of such machines) are dutiable under Tariff No. 231 (1) *b* (1) at the rate of 14 marks 70 penni (say 11s. 9d.) per 100 kilogs.

Generators and transformers (which are to be dutiable separately) are dutiable under Tariff No. 231 (1) *c* at the rate of 47 marks 10 penni (says £1 17s. 8d.) per 100 kilogs.

JAPAN.—According to a decision issued by the Yokohama Custom House, electric condensers are to be dutiable on importation into Japan under Tariff No. 547 (3) at the rate of 25 per cent. *ad valorem*, the decision to come into force on February 5th, 1916.

BRAZIL.—H.M. Minister at Rio de Janeiro has telegraphed to the Foreign Office that a Commission is to be appointed to study the question of the revision of the existing Brazilian Customs Tariff. The result of the Commission's labours is to be embodied in a Bill which is expected to be laid before the Brazilian Legislature for discussion at the next session.

RUSSIAN FAR EAST.—The official *Bulletin of Laws*, of Petrograd, has published a Decree, which received the Imperial assent on October 10th/23rd, imposing Customs duties on certain goods imported into the Russian Far East. In virtue of this decree a number of articles which were formerly exempt from Customs duties on importation into the Governor-Generalship of the Pri-Amour and into the Transbaikal Territory of the Governor-Generalship of Irkutsk are in future to be subject to duty, when imported into these regions, at the rates fixed by the Russian Customs Tariff. Among these articles may be noted the following:—

	Rate of duty. Roubles.	Copecks.
Carbons for electrotechnical purposes, weighing—		
(*a*) less than 10 funts each ... ... per poud	8	80
(*b*) 10 funts or more each ... ... per poud	1	10
Electrical cables of all kinds ... ... per poud	7	37
Machines and apparatus, etc., as follows:—		
All kinds of machines made of copper or its alloys, or in the composition of which copper or any alloy of copper is present in a proportion exceeding 25 per cent. of the total weight of the machine ... ... per poud	9	90
Dynamo-electrical machines and electro-motors of all kinds; electrical transformers ... ... per poud	9	35
Parts of machines not specially mentioned (whether imported separately or together with the machine) composed of copper or copper alloys, per poud	9	90
Parts of dynamo-electrical machines and transformers are admitted under the immediately preceding classification, except the parts enumerated below:—		
Induction coils ... ... per poud	19	47
Armatures and commutators ... per poud	14	02½
Frames with parts (other than brasses) of copper ... ... per poud	9	35

Poud = 36 lb.; 100 copecks = 1 rouble = 2s. 1½d. at par.

"Z" Lamp Festivities.—On December 22nd, at Lawrence Hall, Southfields, S.W., the works entertainment of the "Z" ELECTRIC LAMP MANUFACTURING CO., LTD., was held. It took the form of a tea and concert, at which 200 were present. Among the items in the programme were sleight-of-hand feats by Mr. J. H. Palmer, the works foreman.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

17,753. "Method and means of indicating or recording the frequency of periodic currents." N. C. F. JENSEN. December 20th.

17,753. "Control of electrical measuring instruments." M. J. E. TILNEY and N. C. F. JENSEN. December 20th.

17,754. "Variable automatic electric power cut-off device for auxiliary printing machinery." H. V. JAMES. December 20th.

17,776. "Combined electric grate and fan which could be used on floor, on a table, or hanging from the ceiling of a room." K. S. JASSAWALLA. December 20th.

17,780. "Electric relays." BRITISH THOMSON-HOUSTON CO., LTD., & E. B. WEDMORE. December 20th.

17,833. "Systems of electric welding." D. H. WILSON, J. M. ANDERSON, and K. L. CURTIS. December 21st. (Convention date, December 31st, 1914, U.S.A.) (Complete.)

17,834. "System of electric welding." D. H. WILSON. December 21st. (Complete.)

17,844. "Starting and lighting sets for automobiles." BRITISH THOMSON-HOUSTON CO., LTD. December 21st. (General Electric Co., U.S.A.)

17,856. "Wave transmission." G. CONSTANTINESCO & W. HADDON. December 21st.

17,857. "Storage of energy." G. CONSTANTINESCO & W. HADDON. December 21st.

17,876. "Keyboard controlling devices." WESTERN ELECTRIC CO., LTD. December 22nd. (Western Electric Co., Inc., U.S.A.) (Complete.)

17,878. "Cyclometer registering movement drop-figure action for electrical watt-hour meters." E. WISEMAN & T. C. KIRTON. December 22nd.

17,901. "Earth current detectors and cut-outs for electrical circuits." J. JOHN & W. J. JOHN. December 22nd. (Complete.)

17,910. "Construction of sparking-plug for internal-combustion engines." A. E. HEATH. December 22nd.

17,921. "Rotary interrupter for electric ignition devices." R. BOSCH (firm of). December 22nd. (Convention date, February 18th, 1915, Germany.) (Complete.)

17,926. "Combined dynamometers and counters, or tachometers." W. M. ROCKSTROH. December 22nd. (Complete.)

17,930. "Electrical fuse boxes or holders." H. W. COX. December 23rd.

17,946. "Selectors for telephone systems." SIEMENS & HALSKE AKT. GES. December 23rd. (Addition to 23,336/13. Convention date, April 20th, 1915, Germany.) (Complete.)

17,949. "Manufacture of thermo insulating material." J. CUTHBERTSON. December 23rd.

17,954. "Means for controlling the speed of a machine." MARCONI'S WIRELESS TELEGRAPH CO., LTD., & C. S. FRANKLIN. December 23rd.

17,956. "Electrical selectors or impulse responders." RELAY AUTOMATIC TELEPHONE CO., LTD., & L. C. BYGRAVE. December 23rd.

17,962. "Electric switches." H. K. TRECHMANN & BRITISH THOMSON-HOUSTON CO., LTD. December 23rd.

17,974. "Electric couplers for organs and like musical instruments." H. WILLIS, JUN., & A. S. COOKE. December 23rd. (Complete.)

18,016. "Automatic electric lamp filament replacement device in connection with signal lamps on board ship." W. G. KIMBER & A. L. ENGLISH. December 24th.

18,017. "Driving and control mechanism of planing and like machines." IGRANIC ELECTRIC CO., LTD. December 24th. (Complete.)

18,019. "Signalling by wave transmission." G. CONSTANTINESCO & W. HADDON. December 24th.

18,020. "High-frequency wave transmission generator." G. CONSTANTINESCO and W. HADDON. December 24th.

PUBLISHED SPECIFICATIONS.

1914.

23,563. ELECTRIC RINGING APPARATUS OR OTHER MECHANISM HAVING POLARISED ELECTROMAGNETS. V. Cleue and G. Bonneuil. December 4th. (December 17th, 1913.)

23,566. ELECTRICALLY-OPERATED TABULATING AND LIKE MACHINES. C. A. E. A. Greene & British Tabulating Machine Co. December 4th.

24,013. PREPAYMENT ELECTRICITY METERS. Landis & Gyr Soc. Anon. December 14th. (December 17th, 1913.)

24,543. BRAKE MAGNETS FOR ELECTRIC METERS. O. T. Blathy. December 23rd. (December 23rd, 1913.)

1915.

1,483. INTEGRATING ELECTRIC WATTMETERS. J. Hikeley. January 29th.

3,860. ELECTRIC FIRE ALARUM CONTACT MAKERS. R. G. Hislop. March 11th.

4,054. ELECTRICAL TURNING GEAR FOR STARTING INTERNAL-COMBUSTION ENGINES. F. H. Royce & Rolls-Royce, Ltd. March 15th.

4,585. PROTECTION OF ELECTRIC CABLES. J. H. Bowden & H. F. J. Thompson. March 24th.

8,895. ARRANGEMENTS FOR PROTECTING TELEPHONE, TELEGRAPH, AND THE LIKE INSTRUMENTS AGAINST LIGHTNING OR EXCESSIVE ELECTRIC POTENTIALS. A. E. Beattie. June 16th.

11,555. PRODUCTION OF UNDAMPED OR SUSTAINED ELECTRICAL OSCILLATIONS. F. K. Vreeland. August 10th.

Electrical Prosperity Week.—From the accounts which have reached us it appears that the celebration of the Electrical Prosperity Week throughout the United States resulted in a huge success, and public interest was aroused to an unprecedented extent. In Philadelphia, according to the *Electrical World*, prizes for electrical decorations were given to the amount of £100 per night, and 1,160 wiring contracts were signed on special terms; an electric show at Memphis was crowded (admission free), and in Syracuse the electric lighting company was highly pleased with the results obtained; in Milwaukee, during the first two days of a co-operative exhibit, orders for more than £10,000 worth of goods were received, and similar exhibitions took place in many other centres, always with prodigious success.